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PROBLEMS IN CHINA.*

By JAMES M. HUBBARD.

IN 1724 the Emperor Yung-ching proscribed the Christian religion, which at that time had made great progress in China. Three Jesuit priests who were in Peking addressed a petition to him, supplicating him to revoke his decree. Yung-ching summoned them to his presence, and in an argument of some length gave his reasons for his action, in which he disclaimed any disbelief in or hatred of Christianity. "You say that your law is not a false law, and I believe it. If I thought it were, what should hinder me from destroying your churches and driving you from the Empire?" He closed with these words: "You wish to make the Chinese Christians, and this is what your law demands, I know very well. But what in that case would become of us? The subjects of your kings! The Christians whom you make recognize no authority but you; in times of trouble they would listen to no other voice. I know well enough that there is nothing to fear at present; but when your ships shall be coming by thousands and tens of thousands, then, indeed, we may have some disturbances."

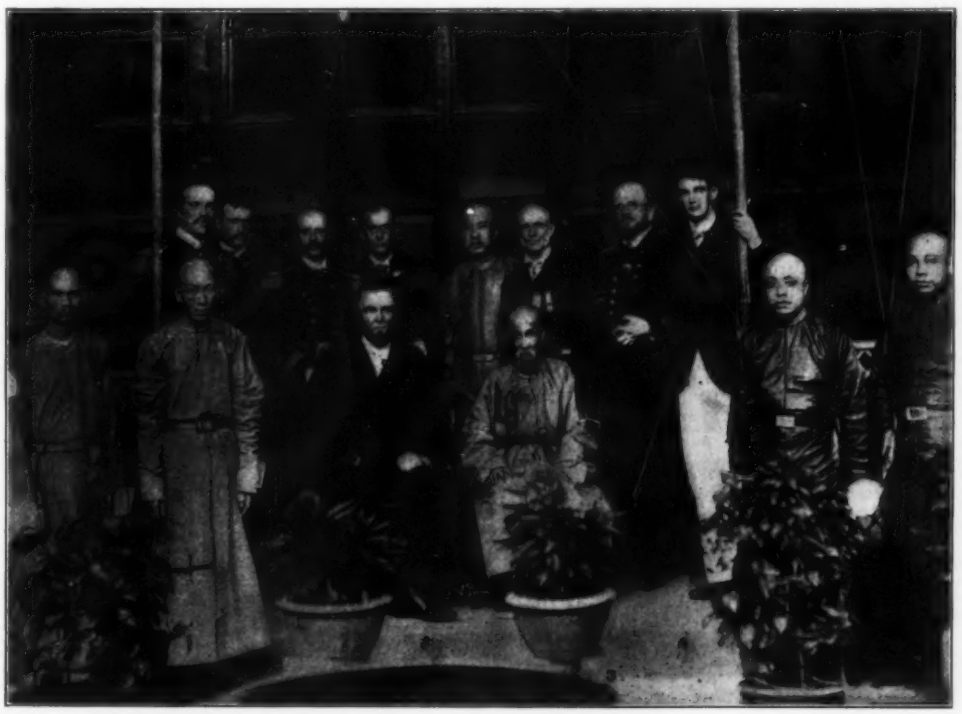
This remarkable statement is interesting both as showing the intelligence and liberality of a Chinese ruler nearly two centuries ago, and also as being a concise statement of one of the principal causes of the present upheaval in China. Christian law demands an obedience which undermines and finally overthrows the authority of every other conflicting law. This fact the intelligent Chinese of to-day recognize more clearly even than did Yung-ching, and the vindication of the authority of the Chinese law is the main object of the present conflict. The distinction between the two laws, the Christian and the non-Christian, leaving religious dogmas out of view, may be said to lie in the fact that Christian law demands obedience to these three principles: the right of every man, whatever his condition or station, to his life and to his property and the inviolability of a promise—the sacredness of the truth. Non-Christian law is practically a denial of the authority of these fundamental principles. It is not meant by this statement to affirm that there have not been in the past and that there are not now many men in China who are just, upright, humane, and strictly honest. It is an indisputable fact, however, that human life has little value in that country; justice is almost unknown in the courts, and there is no respect for the truth—a promise is kept only when self-interest makes it worth while. Now, a conflict is inevitable when two civilizations founded on such antagonistic principles come into close contact, and its ultimate cause will be found to be the assertion on the one hand, the denial on the other, of one or all of these principles. Here, again, there is not the slightest intention of maintaining that in all the relations of China with the Western powers, when disputes have arisen, she has always been in the wrong, they always in the right; but it is meant simply that the cause or pretense of every aggressive act on the part of the powers has been either that a foreigner's life has been taken, his property alienated or destroyed, or the terms of a treaty or concession have not been faithfully observed.

The incident which was probably the immediate cause of the Boxer rising—the murder of two German missionaries by a mob—is a typical one. From the Western point of view, it was only just and reasonable that first the magistrate of the town or district where the outrage occurred, then the ruler of the province, and lastly the government in Peking should be held responsible for the death of these two men. We may justly condemn the method which Germany pursued to secure reparation for the deed; but this does not alter the fact that she was right in her original contention that satisfaction should be given for the taking of the lives of her subjects, and that she would have failed in her duty if the outrage had been suffered to pass unnoticed. From the Chinese standpoint, however, nothing could seem more unreasonable, more absurd, than the demand that the governor of Shantung should be punished because two insignificant men were murdered by a mob, whose deed possibly he did not justify and could not have prevented had he so desired. This German demand would naturally seem to them the mere arbitrary exercise of power, with the ultimate purpose of conquest, not the fulfillment of a sacred duty.

Fertile in international disputes, sometimes leading to war, have been the commercial treaties concluded with the powers, and the railway, mining, and other industrial concessions granted to foreigners. There is no contention that these have always been in the interest of China. In one notorious instance—the forcing her to admit opium—it was certainly not the case. But the universal experience has been that when it has seemed to be for the interest of China to evade the rights granted under the treaties, or to make the concessions valueless, she has done so, often bringing great losses to individuals who have trusted in her promises. The interior navigable waters, for instance, were made free to foreign vessels in the summer of 1898, and large sums were spent in fitting out craft for this traffic; but when, on reaching China, an attempt was made to employ them, the authorities put such obstacles in the way that this "concession" became a dead letter. They justified their action by the contention that it was in the interests of the river boatmen, whose means of livelihood would be taken away by the introduction of foreign steamers, which was no doubt true to a great extent.

This, then, is a principal cause of the present conditions in China. It is the mutual hostility of two distinct and diverse civilizations brought into intimate relations. In the one rights are maintained which seem to the other no rights—an obedience to a fundamental law demanded whose authority the other does not recognize.

Another, and possibly as significant a cause, is to be



From The National Geographic Magazine for August.

FROM THE LATEST PHOTOGRAPH OF MINISTER CONGER, TAKEN IN MAY, 1900.

1. Minister Conger. 2. Viceroy Foo Chow. 3. United States Consul. 4. Commander Knox, United States Navy; United States Naval Officers and Chinese Officials.

By courtesy of The Evening Star, Washington, D. C.

From The National Geographic Magazine for August.

POLICE COURT—SHANGHAI.

From Commander Harrie Webster's collection of Chinese pictures.

* From The National Geographic Magazine for August.

found in the fact that resistance to a ruler "so soon as he ceases to be a minister of God for good," is incumbent on every Chinaman. "This sacred right of rebellion was distinctly taught by Confucius, and was emphasized by Mencius, who went the length of asserting that a ruler who, by the practice of injustice and oppression, had forfeited his right to rule, should not only be dethroned, but might, if circumstances required it, be put to death." For two hundred and fifty years the Chinese have been the subjects of Manchu or Tartar sovereigns, alien to them in race and disposition. Nomads by descent, these Emperors of the present dynasty have retained some of the barbaric characteristics which distinguish a pastoral from an agricultural and commercial people such as the great mass of the Chinese are. Their single aim has been, not to develop the resources of the Empire, but to consolidate and strengthen their power. One result of their methods of government is the prevalence of official corruption to an extent previously unknown. The principal officers of the provinces are appointed for three years only, to prevent their gaining an undue and dangerous influence. The chief duty of the governor with relation to the Emperor is to send an annual tribute to Peking, upon the size of which depends his favor at court. Naturally his one object during his short term of office is to extort as much money as possible from his unfortunate subjects, and his example is imitated by all his subordinates down to the lowest magistrate. Now, it has been perfectly evident to all intelligent Chinese that as their government has grown more corrupt it has become weaker. Its weakness has never been demonstrated so clearly to them as in the latest times, in the ignominious defeat by Japan, the absolute inability to resist the occupation of Chinese territory by the German, Russian, English, and French powers. Here are conspicuously, then, the conditions which make it the duty of a faithful disciple of Confucius to rebel against his ruler: injustice, oppression, and incompetency.

Added to this impulse to revolution is his unfading memory of a glorious past when China was under the guiding care of sovereigns of his own blood. It has only needed at any time in the last century a leader of ability and a definite cry to cause the discontented people to break into open revolt. Such a leader fifty years ago was Hung-siu-tsuen. The founder of a "Society of the Worshippers of God," he proclaimed himself "as sent by heaven to drive out the Tartars and to restore in his own person the succession to China." Multitudes flocked to a standard raised "to extirpate rulers who, both in their public laws and in their private acts, were standing examples of all that was base and vile in human nature." Hung-siu-tsuen defeated the imperialist forces sent against him, and in 1853 he stormed the great city of Nankin. Here a native Chinese Taiping dynasty was inaugurated, of which he was the first Emperor, assuming the title of Taiping Wang, King of Great Peace, or Heavenly King. Subordinate aims were the destruction of idolatry and the prohibition of opium.

It was in its origin a religious and temperance as well as a national movement. This is not the time to discuss the causes of its rapid degeneracy and final overthrow, in 1864, by General Gordon, nor the strange blindness of the Western powers to its distinctively Christian character. The Taipings, for instance, based their moral teachings on "The Ten Words" of Moses. They observed the "Lord's Day" and printed and distributed thousands of copies of translations of Genesis, Exodus, and St. Matthew, as well as Christian devotional works. "The temples were burnt and thrown down," says an English eye-witness, "and not a whole image was to be seen in the city or country for hundreds of miles." Had the powers given the movement their support, it is not impossible that the pure and high aims and motives with which it began might have been maintained. In that case there can be little doubt that the Taipings would have taken Peking, and that a new era of peace and prosperity might have opened for China.

This conviction of the wickedness of their present rulers, whether judged by Confucian or Christian standards, has not decreased in strength during the last half century. Many causes, on the contrary, besides those political ones already mentioned, have contributed to make it stronger to-day in multitudes of Chinamen than ever before. It is by no means impossible that the Boxer rising, with its watchword of "China for the Chinese," was originally a nationalist movement for the overthrow of the Tartar dynasty, as well as for the driving out of foreigners and the extirpation of Christianity. But the influences which led primarily to the Taiping rebellion have increased tenfold in force since 1850. Education of the Western type has been extended to tens of thousands in all parts of the Empire. A literature, both religious and secular, setting forth the principles on which Western Christian civilization is founded and familiarizing the Chinese readers with Christian ideals of life and character, has been created. The intercourse with travelers, merchants, officials, and missionaries, together with the not inconsiderable number of Chinese who have visited our countries and returned to tell of what they had seen to their countrymen, has spread broadcast a more or less definite knowledge of the outside world.

The natural outcome of all these influences has been the birth of a reform party which increased in strength with such rapidity that, having gained the ear and confidence of the Emperor, it seemed but just now to be on the point of revolutionizing the ancient methods of government and education. Its principal aims are shown in the seven famous Reform Edicts issued by the Emperor in the spring of 1898. These provided for the building of railways; the abolition of the old essay system of the civil service examination and the substitution of Western learning; the turning of unused temples into schools for instruction in this learning; the establishment of a great university in Peking; the organization of a bureau for the translation of Western literature into Chinese; the foundation of a patent office; and the protection of foreigners, and especially missionaries. Although this strenuous, though possibly ill-timed and too sweeping, effort for reform, disastrously failed, the leaders being executed or flying from the country, yet the influences which called it into existence remain. Doubtless the events of the past few months will have increased rather than diminished the number of its open or secret adherents.

These are, then, in my opinion, the principal causes of the present outbreak in China, whose ultimate consequences it is impossible for the wisest of us to foresee. It is the inevitable conflict of two essentially diverse civilizations brought into close contact. It is also the result of conditions due to a long succession of weak and corrupt rulers. These appear to me to include all special causes, both religious and political. Though the outbreak was directed apparently at first against Christian missionaries and their followers, and is now for the moment a life and death contest with all foreigners, yet hatred of Christianity cannot be attributed to the Chinese as a people. Their indifference to all religion is a national characteristic. There is no question but that their superstitious fears have been often awakened by the desecration of ancestral graves through the construction of railways, by the erection of churches with high towers, and by the refusal of native Christians to join in some religious rite considered essential for the common welfare, as to avert a drought or heal a prevailing sickness.

It is more than likely, it is certain, that many good but over-zealous missionaries have unnecessarily aroused opposition through lack of tact and prudence in attacking customs and beliefs which ages of existence had made sacred. The Catholic priests especially have incurred heavy responsibilities by their claim to sit as magistrates with the mandarins in cases in which the interests of members of their flock were at stake. The motive for obtaining the privilege was a good one, to secure justice, but the result has been in many instances disastrous.

The often repeated saying: "First the missionary, then the consul, then the general," rests on an undoubted basis of truth. The missionary no sooner gains a foothold in any land than he is closely followed by the trader of his own or some kindred nationality. He in his turn brings after a time the consul, his government's representative to protect his interests, and with the consul comes a guard which circumstances may change into a conquering army. This is a natural, an almost inevitable sequence, and one that abundantly justifies the Chinese suspicion that the original coming of the missionary is simply to prepare the way for the general. The history of Protestant missions, we do not say Catholic, bears triumphant proof, however, of the falsity of the assertion of such a motive in endeavoring to Christianize a heathen people.

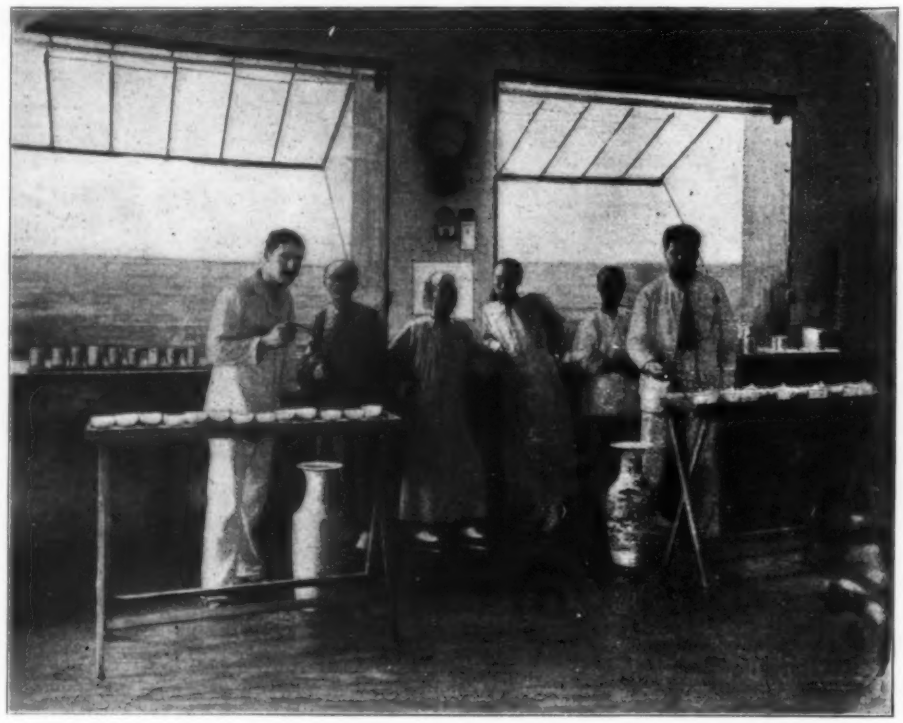
What is to be the end of the contest now being waged in Northern China? To this question there is but one answer that can be made with any degree of confidence. Peking must fall into the hands of the allied powers. Whether or not the present rulers of the country will be captured with it remains to be seen, though all the probabilities are against it. But if they fly to the ancient Chinese capital, Singan Fu, in the province of Shensi, 750 miles inland, and set up the government there, what then? In other words, can the powers, either unitedly or singly, conquer China or any considerable part of it not adjacent to the sea? If the Chinese are united in their opposition to the powers, I believe this to be an impossibility from the physical character of the country and the number and disposition of the people.

China proper, that is, excluding Mongolia, Manchuria, Tibet, and Turkestan, is, in round numbers, 1,500 miles in extent from east to west, and 1,400 miles from north to south. It is, roughly speaking, divided into three great river basins, which are separated from each other by ranges of mountains. The northernmost is that of the Yellow River and consists in large part of a plain, subject to terrible inundations, from the fact that it lies below the level of the river, which now and then bursts its banks and makes for itself a new channel. It is unnavigable and apparently would afford no aid to an invading army. This is not true of the second or Yangtze River, which is navigable for nearly 2,000 miles and has numerous tributaries navigable for small craft. This is the richest part as well as the most populous of the Empire. The deltas of these two rivers are connected by the Grand Canal, formerly a great avenue of trade, upon whose banks were important cities. Sections of it are now in ruins, and even if it were in good repair it runs throughout its entire length so near the coast as to be useless to an army invading the interior. The third river is the West, in the extreme southeastern part of China. It is navigable for some 200 miles and would give access only to two provinces, only one of which, Kuangtong, is of any importance.

These river basins were formerly connected by imperial roads, constructed before the Tartar conquest, and even in their ruins excite the admiration of travelers and attest the height to which Chinese civilization once reached. The present rulers have suffered them to fall into decay and comparative disuse, as rapid and easy communication between the different parts of the Empire was considered dangerous, as affording a discontented subject people opportunities to combine against their rulers. It will be evident that to march armies sufficiently large to subdue 400,000,000 people through such a country—armies almost all of whose munitions of war would have to be transported from the coast—would be a physical impossibility.

Then the Chinese, when hard pressed, are capable of using means of defense against which the best equipped European armies, led by the ablest generals, would be as powerless as if they were naked savages. On one occasion the inhabitants of the northern province of Honon, being unable to meet an invading army in the field, "cut through the dikes of the Yellow River, 'China's Sorrow,' and flooded the whole country." The invaders escaped to the mountains, but upward of 200,000 natives perished in the flood, and the city of Kaifeng was destroyed. Another time, "in the first period of the Manchu dynasty, the Chinese had the patriotism and resolution to lay waste their own coasts as far as twenty leagues up the country, and destroy villages and cities, burn woods and cornfields—in fact, to create an immense desert—in order to annihilate the power of a formidable pirate, who for a long time had held in check the whole strength of the Empire." What this extraordinary people have done more than once in their stress they would do again under similar circumstances.

But are they united and animated by the single desire of driving out the "foreign devils"? It does not seem to me that there is any evidence of this other than the mere assertion of writers who have apparently taken it for granted. A united purpose impelling the ignorant myriads of Chinese, divided in speech and in habits of life and separated by vast distances, is inconceivable. Hatred of the foreigners is, I believe, in large measure confined to the ruling classes, whose powers and privileges are threatened by the new religion and the reforms which it brings with it. The Chinese magistrate who sells justice to the highest bidder naturally hates the consular court. It is they and the literati, or educated class, from whose ranks they are drawn, who foment these disturbances; who placard the cities with inflammatory invitations to rise up against the foreigners; who circulate scandals about the Christian rites, similar to the assertions made and believed in France and Austria about the Jews. That they are able to arouse the common people to action here and there, especially in the coast provinces and in large cities and their neighborhoods, recent events have proved. It is possible, but hardly conceivable, that they could do the same throughout the Empire, for it should be remembered that there are still great districts, inhabited by millions of people, into which missionaries have never gone and through which foreign travelers rarely, if ever, pass. At present I am convinced that the great mass of the people throughout China are ignorant of what has taken place at Peking and Tien-Tsin; they are indifferent as to who



From The National Geographic Magazine for August.

SAMPLING TEA—SHANGHAI.

From Commander Harrie Webster's collection of Chinese pictures.

rules over them, provided they are left in peace to till their fields and reap their harvests.

Does the Western world need China, and, reciprocally, does China need intercourse with the Christian nations? Many persons question seriously whether we ought to force, as it were, our civilization, our commerce and manufactures, our modes of government, our literature and religion, upon an unwilling people, the mass of whom are probably as well off materially as the mass of the people of Europe. They are probably better off than the Russian peasants. The accounts of some travelers lead one to believe that in some parts of the province of Szechuen the inhabitants surpass all other peoples in their apparent prosperity and contentment. Why should we come and disturb this peace? In answer it is only necessary to say that the commercial and religious invasion of China by the Western nations is a part of the progress of the world. China is no longer at a distance from us, but is the near neighbor of Russia, England, France, and the United States. She is one of the great nations of the world, and mutual intercourse between her and them is inevitable. Its advantages, even from the lowest material point of view, are not all on one side. Her foreign commerce, amounting to nearly $300,000,000 annually, not only pays a third part of the expenses of the central government, but enriches her merchants, tea cultivators, and the raisers of silk as much as it does our manufacturers of cottons. And this commerce is but a small fraction of what it will be when her vast virgin fields of coal and iron are exploited and the whole Empire is thrown open without restriction to all who desire to enter.

CHINA AND HER PEOPLE—SOME REFLECTIONS ON THEIR MANNERS AND CUSTOMS, HABITS, AND LIVES.*

By Commander HARRIE WEBSTER, U. S. N.

THE geographical boundaries of China proper, that huge Mongolian Empire about which the world is now

From The National Geographic Magazine for August.

A TYPICAL CHINESE VILLAGE AND CANAL.

From Commander Harrie Webster's collection of Chinese pictures.

so deeply concerned, are: on the north, Mongolia, from whence, at irregular intervals in the past, have come those overwhelming currents of humanity which have modified in a remarkable degree the race characteristics of the Chinese; on the east, the great Gulf of Pechili, the Yellow Sea, and the Pacific Ocean; on the south the China Sea, the Gulf of Tonkin, Tonkin, and Siam; and on the west, Upper Burma and Tibet. Some writers, notably Wells Williams, the well-known author of "The Middle Kingdom," divide China proper into three portions, the mountainous, the hilly, and the level country. Employing this system, we find more than half of the whole area is mountainous, and lies west of a north and south line passing through the city of Wuchang, in the province of Hupeh. The hilly portion lies east of this same line and south of the great Yangtze River. The great plain or level country comprises the remaining part of the Empire, and forms the northeast portion. The agricultural wealth of the nation lies in the level country.

China is divided into eighteen provinces, each of which is governed by a viceroy, who administers the affairs of his province nominally under instructions from Peking, but actually in accordance with his individual ideas. During the progress of ages the spoken language of these provinces has undergone such modifications that it is practically impossible for a traveler to understand or be understood outside the borders of his own province. The partial exception to this rule is the Cantonese. The spoken tongue of the province of Canton, or Kuangtong, as it is pronounced by the natives, appears to be the parent speech of a large part of China, so that to-day a native of Kuangtong can make his way with more or less ease from one end of China to the other. A witty Chinese gentleman once said to the writer at a native dinner in Shanghai, "With two languages a man may travel all over the world. Knowing the Kuangtong dialect, he may travel all over China, and with English he can make his way over the rest of the world." The written language, however, is practically alike for all portions of the Empire, and the educated Chinaman can make his wants known with brush and paper in any part of the kingdom.

The two rivers flowing through the Celestial Empire with which the world is most familiar are the Hoang-ho, or Yellow River, and the Yangtze. The first is frequently called by Chinese writers "The Sorrow of China," on account of its frequent and disastrous inundations. Rising in Kuku-nor, it enters the province of Kansu, and passes the ancient city of Lanchau, capital of the province, eight hundred miles from its source. Flowing along, parallel with the Great Wall for five hundred and thirty miles, it passes beyond the borders of China into Mongolia. Reëntering the Flowery Kingdom between the provinces of Shensi and Shansi, forming their boundary, the river, increasing in size as it flows, strikes eastward to the sea through Honan and Shantung, passing the walls of Kaifeng and Tsinan in its course. In former days the Yellow River, after passing Kaifeng, flowed still farther to the eastward, through the province of Kansu, sweeping into the Pacific Ocean some hundred miles north of Chinkiang, on the Yangtze.

The great Yangtze rises in Tibet, and after flowing more than a thousand miles through a thinly populated country passes into China near Batang, in the province of Szechuen. At this point it is locally known as the "Kinsha," or River of the Golden Sand. Flowing from here south and east, it forms the boundary between Szechuen and Yunnan, receiving a large tributary, the Kialing, from the north. Passing through the province of Szechuen and past the walls of Chungking, the river enters the populous province of Hupeh and rushes through the magnificent gorges to Ichang-Hankau, Wuchang, and Hanyang, at the confluence of the Han River with the Yangtze and the head of deep-water navigation are passed, and from here, skirting the northern extremity of Kiangsi Province, at Kiukiang, near the mouth of the celebrated Poyang Lake, the river strikes northeast, entering the province of Kiangsu near Nankin, the ancient capital. After intersecting the Grand Canal at Chinkiang, the Yangtze discharges its immense volume of water through two magnificent deltas.

The canal system of China is the most extensive in the world, with the possible exception of that of Holland. Wherever the lay of the land permits the thrifty native has made a canal. Thus he is enabled to carry the products of his labor to a market with the minimum of expense. It must be acknowledged, however, the process is carried out with the expenditure of the maximum of time. The waterways range in size from the Grand Canal, hundreds of miles in length and navigable by deep-water junks, to the little "neighborhood" canal of barely sufficient width for two sampans to pass each other. They serve not only the purpose of navigation, and, in place of roads, for trade and commerce, but also as local fish preserves, as breeding pools for water fowl, and for laundry purposes. In most of the canals there is more or less current, as they are not the menace to health that is generally supposed.

There are thirty one "open ports" or "treaty ports" which by various treaties with the government are open to the traders of all nations. No passport is necessary to enter these cities; but the prohibition against travel outside the free zone is strictly enforced. The free zone extends to the walls of the city, and the curious traveler ventures beyond at his own risk. Notwithstanding the fact that these ports are open to the commerce of the world, Great Britain is about the only nation which enjoys the full intent of the various treaties and conventions on the subject. This is especially true of the rich and populous towns of the Yangtze Valley.

The present Emperor of China, Kuangsü, is the son of Prince Ch'un, the seventh son of the Emperor Taokuang. He succeeded his cousin, the late Emperor Tung-chi, who died childless January 12, 1875, of smallpox. The proclamation announcing the accession of Kuangsü was as follows:

"Whereas His Majesty, the Emperor, has ascended upon the Dragon to be a guest on high, without offspring born to his inheritance, no course has been open but that of causing Tsaitien, son of the Prince of Ch'un, to become adopted as the son of the Emperor Wen-tsung-hien (Hien-fung), and to enter upon the inheritance of the great dynastic line as Emperor by succession.

"Therefore, let Tsaitien, son of Yih-huan, the Prince of Ch'un, become adopted as the son of the Emperor Wen-tsung-hien and enter upon the inheritance of the great dynasty as Emperor by succession."

The present Emperor is the ninth sovereign of the Manchu dynasty of the Ta-tsing (Sublime Purity), which supplanted the dynasty of Ming in 1644.

There exists no law of hereditary succession to the throne, but it is left to each sovereign to appoint his successor from among the members of his own family. The late Emperor, dying suddenly in his eighteenth year, did not designate his successor, and it was in consequence of palace intrigue, directed by the Empress Dowager, in concert with Prince Ch'un, that the infant son of the latter was declared Emperor. The Emperor Kuangsü, now in his twenty-ninth year, nominally assumed the reins of government in March, 1887. He married Ye-ho-na-la, niece of the Empress Dowager, February 26, 1889, and was enthroned in March, 1890.

The Emperor is the spiritual as well as temporal sovereign, and as high priest of the Empire can alone perform the great religious ceremonies. No religious hierarchy is maintained at public expense, nor is any priesthood attached to the Confucian or state religion.

A characteristic of the Chinaman in his desire for education. So thoroughly imbued is the national spirit with the thirst for knowledge that it is safe to say that no other people are so generally and so well educated as the Chinese. Every boy is compelled by law to attend school a certain period of the year. Among the poorest classes, where the struggle for existence is fierce and unrelenting, among what are known as the coolie class, scarcely an individual can be found who cannot read and write, and this, too, not haltingly and with difficulty, but freely and so far as can be understood by an observer, accurately and understandingly. The word "coolie" is not a term of reproach, but signifies laborer or workman, and is used among the Chinese themselves with this meaning. As in other parts of the world, the coolies or laborers are recruited from the lowest strata of the body politic; but, as has been pointed out, practically without exception they read and write their own complicated language.

During a recent cruise in Chinese waters I became much interested in noting the manner in which the lowest classes acquired their ability to read and write, and the result of several years of observation is that their education comes largely through the steady and persistent use of the stray minutes of life. As soon as a piece of work is done, while waiting for a fresh job, or even standing in line, waiting his turn to deposit his package, bale, or cask, the coolie plays with a stick or bit of bamboo, writing a character over and over, or studies a few characters written on a bit of paper brought from a pocket. Thus the minutes of waiting are employed in the acquisition of one more tiny bit of knowledge.

In physical appearance the natives of China vary widely from extreme north to south. While our experience in the United States leads us to think that the race is small and undersized, a brief residence in the northern provinces of the Empire will go far to dispel this impression. At Chifu, Taku, and Tien-Tsin one is struck by the stalwart appearance and height of the natives. At the first-named port large numbers of the men are six-footers, and among the boatmen of Chifu it is no uncommon thing to see a native over six feet in height weighing nearly or quite two hundred pounds. In the south, however, the average is more nearly accordant with the specimens we encounter as laundrymen, gardeners, and "coolies" generally in the United States. The well-known queue or pigtail by which Chinamen have become so well known is the visible mark imposed by their Manchurian conquerors in 1644. Notwithstanding the length of years since the imposition of this mark of subjection, there are large numbers who resent the queue. At Swatow the singular spectacle is presented of Chinamen wearing turbans! Unable to avoid shaving their heads and plaiting their hair in accordance with the Tartar edict, these people conceal the marks of their degradation beneath a veritable turban, fashioned closely after the Arabian model. It presents a curious anomaly in a country so thoroughly controlled by precedent and tradition.

The singular usages and customs of the people of China have been the wonder and comment of other and younger parts of the civilized world for many centuries. The general trend of such comment has been astonishment at the usual manners and methods prevailing among the millions of the yellow subjects of the Son of Heaven. In clothing, style of living, care of children, amusements, and in many other points the Chinaman is different from the rest of the world. This view, however, is not quite a correct statement of the matter. The Chinese methods undoubtedly antedate Western methods, and so, logically, the Chinaman, having adopted a certain manner of living, has the prior right to the system, and variations from his system should be counted singular. I am well aware that this method of argument is not the usual one, but it is certainly the most logical. Those of the East naturally take this view, and express surprise that so many things are "done the wrong way" by their Western brothers.

Intimate contact with the civilization of China impresses the observer with the conviction that nearly all their methods are the results of long experience, a survival of the fittest in pretty nearly every branch of human needs and conveniences. One feels that the experimental stage has long since passed away. A

* From The National Geographic Magazine for August.

different way of doing a piece of work does not enter the mind of the Chinese operator for the reason that all other methods have been tried and the present one is the survival! The claims made by the Chinese of priority in the use of many articles and methods are not infrequently well taken, and the writer has often been surprised in observing the common use of articles and their methods of manufacture which in other parts of the world are novelties or inventions of comparatively recent date.

The opposition of this nation to machinery is well known. It exists not only among the presumably ignorant who labor for their daily support, but among the rich and highly educated as well. The reason for this opposition is founded upon social and economic conditions unlike those in any other part of the world.

The Statement is as follows: First, every man in China is a worker, and only by untiring industry is he capable of feeding and clothing himself and family.

Second, all branches of industry are full. There is never lack of labor nor of work to do, and so nicely adjusted have become the economic conditions through centuries of struggle that practical content reigns among the workers, and any upsetting of the equilibrium of supply and demand produces widespread distress.

The Proposition.—Introduce a machine which shall, by the supervision of one man, be able to do the work of ten men.

The Result.—Nine men are thrown out of that particular task. There is no outlet for their industry for the reason given in paragraph 2 of the Statement. Therefore, these nine men must starve, steal, or emigrate. From my observation this is pretty nearly the correct status of the working world in China, and is the underlying reason for the opposition to labor-saving machinery. In this great Empire a labor-saving tool or machine is an economic curse, and will remain so until the conditions are greatly modified throughout China.

It is to be understood, however, that this argument applies altogether to existing industries rather than to new forms of production and labor. The strength of Chinese performance consists in the interminable application of minute effort at a given point. In other words, the application of manual labor will, in the long run, carry out any task, however great, and in the doing the man earns his bread by the sweat of his brow. From his point of view he has no reason for discontent. He is, therefore, industrious, frugal, and probably happy. In China, the Chinaman is a good citizen.

Trade unions for mutual protection are prevalent here to an extent undreamed of outside the Flowery Kingdom. Naturally, the outsider cannot know much of the details of these organizations, but the foreigner's experience will soon tell him the uselessness of contesting the action of any guild or workman's union whose members refuse to work for him. Without excitement or any evidence of dissatisfaction, the coolies working for the foreigner will strike, and no trouble will ensue because of attempts of others to fill the vacant places, as there are no applicants, and the work under way will simply remain unfinished until by mutual agreement the point in dispute has been settled. Strikes in China are seldom disorderly, and the boycott feature is never in evidence.

The question is often asked, How does the education of the better class compare with the educational attainments of a similar class in the United States? This is a very difficult question to answer, and to give a clear explanation would take much time and space. The education of the Chinese boy begins as soon as he can think, and is pursued relentlessly through boyhood and until, by marriage or the demands of business, he seeks a new path for himself. The system of education is based primarily upon thoroughness, and as time is not regarded as possessing any value, it can be understood that each branch of study is carried to its ultimate. The study of the Chinese classics is of the first importance; music, natural philosophy, astronomy, geography, botany, and engineering, all in turn receive careful attention, and because the end proposed to their minds is different from the Western code, it does not follow that the range of study or the intricacies of the subject are in any degree less than with our students. In fact, I am sure that in subtlety of analysis, in the pursuit of the formulated idea to the ultimate and logical conclusion, the Chinese student is far superior to his brother of any nation.

Add to all this the gift by nature of a marvelous memory, accustomed from its first efforts to minute and accurate observation, and it can be understood that the knowledge of an educated Chinaman is of the most superior order from his point of view, and even from our point of view it calls for the highest mental efforts of which the human brain is capable; but as their plane of thought and code of ethics is so opposed to what is called "modern progress," their knowledge does not appeal to the Western mind as being a real education. In mental capacity the educated Chinaman is undoubtedly equal to the highest efforts of the best races.

The business capacity of the race is recognized the world over. It is in this direction that the Chinaman's principal modern triumphs have been achieved. Throughout the East he controls the business of whole communities, and in the banks and financial institutions throughout India, China, Japan, and the Malay Archipelago the Chinese "Shroff" is the business center around which flourishes the vast commerce of the richest portion of the civilized world. Testimony to the Chinaman's business integrity is unvarying, and while it is true that no one is keener in driving a bargain, as soon as the terms of that bargain are settled the Chinaman may be depended on to carry out his agreement without a murmur, even though circumstances may have so changed as to threaten financial ruin. All through the East one is always told that a "Chinaman's word is as good as a bond." Under all circumstances he is commercially honest.

In mechanical ability and skill the Chinaman stands exceptionally high. In the foreign shops and factories of the East the native artisan compares favorably with the workman of any other nation. I refer entirely to Western tools, methods, and machinery. In a broader sense, in the erection of bridges, construction of temples, roads, canals, in the wide sense of the engineer, the Chinaman compares well with his fellows in more civilized lands. Many of his bridges are marvelous, not only for their beauty and accuracy of construction, but in the difficulties overcome and in the solidity of their foundations. Here the Chinaman's characteristic of thoroughness expresses itself. "The Chinaman builds for all time; the rest of the world builds for to-day."

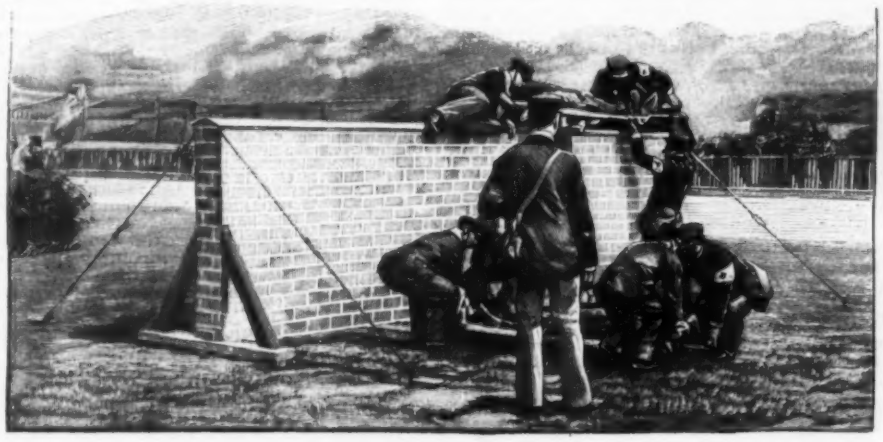
The position of women in the Celestial Empire is difficult for the Western inquirer to grasp, and as the legal and political status of the sex is very low, it is hard to understand the immense social and commercial influence possessed by the wives of the better class of Chinamen. I say "wives" designedly, because plurality is the rule rather than the exception. In general knowledge of affairs the women of China compare favorably with their husbands. Women are educated through a system of private instruction.

In these notes on China and her people it has been the intention of the writer to touch on points of personal or individual interest. The genius of the native Chinaman cannot be grasped in a day, nor is it easy to acquire a knowledge of the family life of these people. Distrust of the "Western barbarian" has become a part of the Chinaman's nature, and not until long acquaintance ripens into friendship does the real man appear. My opportunities for observation and comment extended over a period of nearly forty months, and I count the friendship of several Chinamen of the upper class among the pleasantest memories of a cruise on the China station.

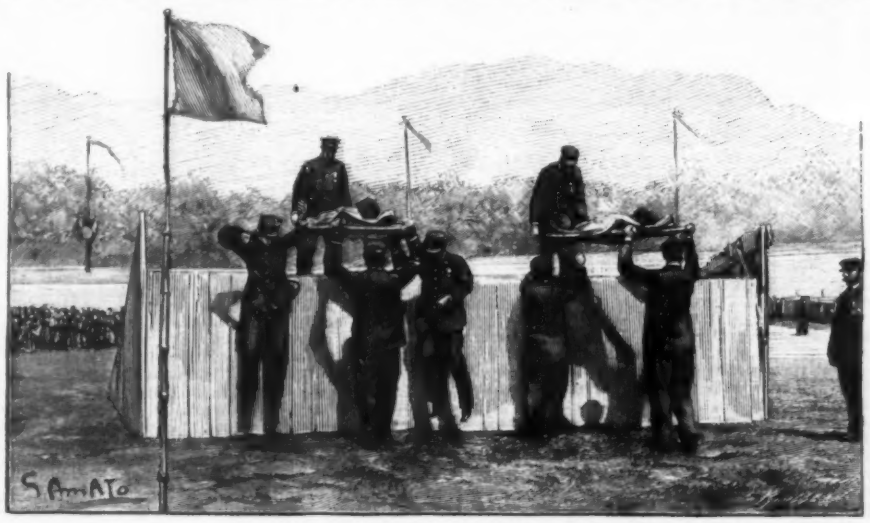
FIRST AID FOR THE WOUNDED.

THE Vincennes annex of the Exposition, notwithstanding its distance, attracts quite a crowd of people every Sunday to witness the sports and the international competition of physical exercises. One Sunday, a few weeks ago, the spectacle offered to those who had wended their way toward the Municipal Velodrome was both novel and picturesque. The programme announced an international competition of aid to the wounded. The various societies proceeded in turn to the installation of relief stations, which the public was afterward allowed to inspect, and which comprised all the usual material—carriages, harness and various apparatus designed for the carriage of the wounded. Then the competitions proceeded with exercises in lifting the patients and dressing their wounds. Several obstacles had been set up upon the lawn of the velodrome, such as walls, hedges and taluses. Here and there were seen young men seated or lying flat upon the ground—the victims of an imaginary battle and bearing placards that indicated the nature of their wound, a fracture of the arm or leg or a ball in the neck, abdomen, etc. Then came the relief corps with their litters, antiseptics in bags or bottles, and rolls of linen, wadding and lint, and lifted each wounded person and bandaged his leg, arm or neck with dexterity, rapidity and delicacy. Then the patient was placed on a litter in a proper posture to spare the part affected. Then, more speedily than they had arrived upon the scene, the litter bearers carried away the patient to the ambulance or hospital.

In coming as well as in going, it was necessary to surmount hedges, walls and taluses and pass their burden over them gently and without shock. It was wonderful to see the skill that had been acquired by these young volunteers grouped in leagues and societies in order to do useful work with disinterestedness. The success of all was the same. Nevertheless, there may be particularly mentioned a corps of volunteer firemen which improvised litters, when the number thereof was inadequate, by passing poles through the sleeves of their jackets or the legs of their trousers, and, laying the patient tenderly thereon, bore him away, while they themselves were clad only in their drawers, shirts or waistcoats.—L'Illustration.



PASSAGE OF A WALL.



PASSAGE OF A TALUS.

TETANUS AND ITS TREATMENT.

THE season of the year is again at hand when tetanus in our larger cities takes on somewhat the character of an epidemic, says The Medical News. Last year some eighty deaths from the disease were reported in the Eastern States. It seems hopeless to expect any abatement of the yearly fireworks nuisance. Until this is attained, the recurring danger from tetanus may be awaited with certainty. It is not the peculiarly-irritating quality of the burns made by the explosives, nor is it the contamination of the fireworks by the tetanus bacillus in packing that causes tetanus to result from these wounds. It is due to the fact that, in the seared and often lacerated wounds made by toy pistols, the tetanus bacillus, so common on our streets in the summer time, finds beneath the surface of the skin, where it is well protected from all contact with oxygen, a favorable nidus for its anærobic growth.

The prime indication for treatment is the free admission of air to every part of the wounded tissues. For this reason it is inadvisable to cauterise wounds in which there is fear of tetanus developing. The searing process, by the production of an eschar, effectually occludes the deeper tissues from the pervasive germicidal influence of the oxygen of the air. It is probable that the cauterization produced by the missile itself is an accessory etiologic factor in the original production of tetanus. For reasons similar to those which seem to contraindicate cauterization, strong antiseptics should not be used on a wound that is suspected of being infected with tetanus bacilli. In the spore stage of the bacillus, which is the form in which it usually occurs in the presence of air, the tetanus bacillus is extremely resistent to the action of chemical germicides. It is futile, therefore, to attempt to destroy entirely the bacilli by such methods. The vital resistance of the tissues is sensibly lowered by their use and the dying tissue serves rather to protect the bacillus tetanus from the inhibitory influence of the free oxygen of the air.

The serotherapy of tetanus has not fulfilled its early promise, yet there still remain encouraging features in its use. When symptoms of severe tetanus have developed, it is practically agreed that anti-tetanic serum is not of much service, at least when administered hypodermically. As a distinguished authority has said, the finitial symptoms of tetanus, as we see them, do not herald the beginning of the disease, but really the

beginning of death from the disease. If possible, treatment should anticipate the manifestation of the nervous symptoms of the disease. For this purpose the injection of anti-tetanic serum as a prophylactic seems advisable in cases in which there is good reason to fear that infection with tetanus bacilli may have taken place. Tetanus serum is now made of such high anti-toxic value that the injection of 2 or 3 c. c. of serum would be sufficient, in the presence of any suspicious wound, absolutely to guarantee immunity from the disease. The mortality of the disease is so high that prophylactic injection seems justified in all cases in which burns or lacerated wounds occur that have been contaminated by street dirt.

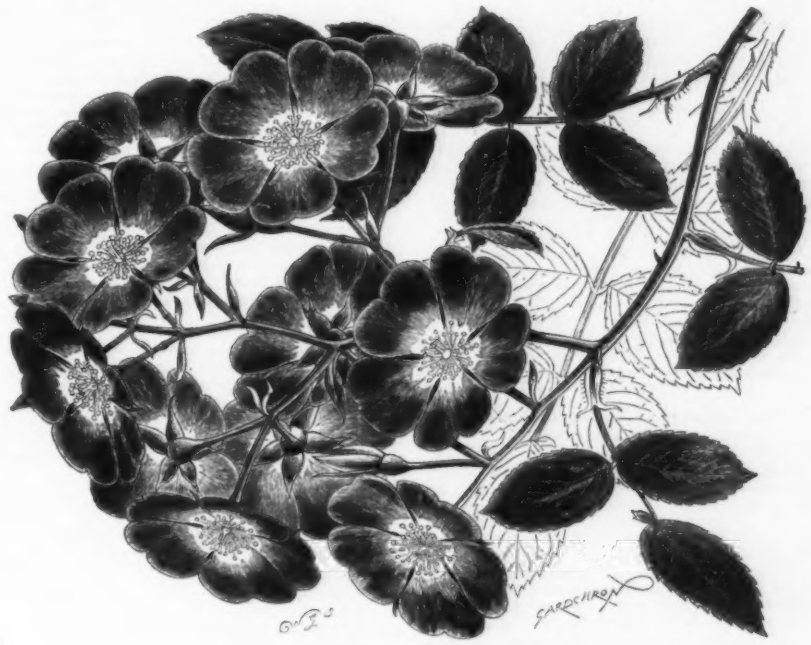
The intra-cerebral injection of anti-tetanic serum has not given all the good results that were expected from it. Those who have used this method of treatment must, however, speak very highly of it and will continue its practice in severe cases. Several cases successfully treated by the injection of anti-toxic serum through a lumbar puncture have been reported. The serum so injected finds its way into the subarachnoid space and very probably also into the ventricles of the brain quite as effectually as if injected intra-cerebrally. Moreover, a certain amount of the toxins of the disease that are known to exist in the cerebro-spinal fluid are evacuated. This method of injection after lumbar puncture is far simpler than intra-cerebral injection. The latter is a major operation; the former can scarcely be dignified longer by the name of operation at all.

Cases of tetanus will unfortunately develop this summer as in other years. For these, early lumbar puncture with injection of 5 to 10 c. c. of anti-tetanic serum should be tried. Where symptoms indicate a very severe type of the disease and of a fulminant character, a preliminary injection of a quantity of normal saline solution a little less than the amount of cerebro-spinal fluid evacuated would serve to dilute the toxins of the disease and assist in their removal before they are fixed within the nerve cells. This washing out of the spinal canal has been done a number of times, although not, we believe, in tetanus.

For suspicious street wounds, the prophylactic injection of tetanus anti-toxin seems not only justified, but demanded as a duty by the present conditions of prophylactic therapeutics. Our bacteriologic knowledge of tetanus, its cause and its toxins, is a triumph of scientific medical anvance. Unfortunately, all this knowledge has, as yet, brought but a modicum of benefit to clinical medicine. Let us hope, however, that our better realization of the conditions of the disease and the suggestions as to methods of treatment that are now before the profession will complete the successful practical application of the great scientific principles that have been established.

ROSE PINK ROAMER.

THIS beautiful single-flowered rose was exhibited at the Royal Horticultural Society's meeting at the Drill Hall, Buckingham Gate, England, on June 5 last. The variety is a cross between Rosa Wichuriana and another unknown variety or species. It is a rambling rose, making shoots of great length, and flowering with much freedom. The flowers measure from 2 to 3 inches in diameter, and are of a rich rose-tint, and have a white center. It received an award of merit when shown at the meeting.



ROSE PINK ROAMER.

PEARY SUPPLY SHIP SAILS.

THE Peary steamer "Windward" sailed recently for the Arctic regions. When she returns it may be to proclaim to the world that the mystery of centuries has been solved, or to confess that failure has once again attended the efforts of the gallant explorer who has fought so strenuously to triumph over the stern, immutable forces of the icy North. Peary is now somewhere in the vast polar solitudes, with two tried companions, Dr. Dederick and "Matt" Hensen, the latter a negro; and whatever measure of success is attained by the white leader, the claims of the black follower cannot be disregarded, for every season of the ten Peary has spent in the Arctic Circle he has had this faithful fellow as his most trusted adherent.

The "Windward" is an English-built ship, a Dundee whaler for many years, and was presented to Peary by Mr. Hermsworth, of London, who sent the expedition to Franz Josef Land. A special bill was passed by Congress at the last session to give her American registry, and her articles record that Lieut. Robert E. Peary, civil engineer, United States Navy, is her master and owner, and that Samuel W. Bartlett, of Brigus, N. F., is navigator and ice pilot. She took Peary north, under the Union Jack, in 1898, and was frozen up in the floe in Kane Basin from August of that year until twelve months later. Peary in the meantime had journeyed north over the frozen continent almost to the extreme point reached by man, when he was struck down by the deadly frostburn and lost seven toes and both heels. Thus maimed and weakened, further progress was out of the question for him, so he decided to rest for a season and send the "Windward" back for new boilers and engines, as well as extra stores and coal, so that he might be fully fortified in attempting another advance, either by sea or land, when his recovery made laborious travel possible for him again.

In these days, when stories of mismanagement in the outfitting of great armies are so common, it may not be amiss to reflect upon the awful consequences which would follow upon a mistake in judgment with regard to the supplying of essentials to the Arctic outpost. The "North Water," of Greenland Channel, is traversable only for two months of the year, and then it requires the coolest and most expert judgment to safely navigate it. The ship which attempts the passage must carry every requisite for the existence of those whom it is proposed to succor, for there is nowhere else whence stores may be drawn or deficiencies in equipment made up. An Arctic cruiser must carry everything, "from a needle to an anchor," and the list of articles included in her supplies would be thought incredible if submitted to an observer unfamiliar with the needs of the Land of Desolation, where the explorers and their ships operate.

PEARY'S SUPPLY SYSTEM.

Ever present with the northern voyager is the fear of a horror as an outcome of some miscarriage of plans, as in 1884, when the Greely party of twenty-eight lost three-fourths of their number by cold and hunger, owing to the crushing of the relief ship in the floe the preceding summer. Since then every precaution which experience and resources can suggest is availed of in order that ample provisions and fuel may be provided at easily accessible points, as a safeguard against unforeseen contingencies. Peary had the "Windward" laden with supplies in 1898, and an auxiliary steamer, the "Diana," went north last season with her hold filled with foodstuffs and coal. The complete stock of provisions Peary has cached on half a dozen headlands between Cape Durville, where the "Windward" lay, and Cape Conger, where Greely's station had been, which Peary re-entered in January, 1899, crippled and well-nigh despairing, after it lacking a human footfall for over fifteen years. The coast line between these two points forms a journey of 250 miles, which is made with the help of dogs and sledges, about ten of the hardy canines being required to draw a heavily laden sledge over the rough and broken surface of the ice-foot, as that which adheres to the shore is called.

The "Windward" was intended by Peary to have been used in an attempt to push up into the Polar Sea and as far toward the pole as possible, but he could not foresee that the boom in shipbuilding would make it impossible to provide her with new machinery, and her defects in this particular will be a bitter disappointment to him when he rejoins her. She has, however, had what repairs were possible to her engines, and her speed has been increased a knot thereby, while her hull has also been practically reconstructed. She will be the first Arctic steamer to carry the American flag within the Arctic Circle since the ill-fated "Polaris" [and the "Jeannette"] sailed from New York in July, 1871.

The "Windward" carries a crew of thirteen—master, mate, boatswain, four seamen, two engineers, two firemen, steward, and stewardess, the latter being really a personal attendant for Mrs. Peary, who, with her little daughter Marie, goes to join her intrepid husband in his far northern home. This is Mrs. Peary's third trip to Greenland, and the little girl was born there seven years ago, and is the most northern-born white child in the world. The crew have signed articles for thirty months and the ship is provisioned for the same period, as it may happen that she may be kept north that length of time. Every crevice below decks which is not otherwise occupied has been filled with steam coal at Sydney, and she also carries a deckload of it, which will be first burned, as the procuring of coal is perhaps the most serious difficulty in the North, though there is a seam in the Waigat Channel, near Disco. Her objective is Etah, an inlet in Smith Sound, well up the west coast of Greenland, where it is expected she will meet Peary or obtain news of him, with instructions to govern her future movements. Etah is where the explorer has made his headquarters the past few years, it being the center of the region where are located the Arctic Highlanders, a tribe of Eskimos who live farther north than any other human beings. They train dogs for Peary, provide skin garments, build sledges, transport goods, and make themselves generally useful. They also drive his dog teams and have accompanied him on one or more of his minor trips, rendering him aid which their knowledge of the region alone enabled him to utilize.

IMPROVED INTERIOR FITTINGS.

In the hold of the "Windward" is a miscellaneous cargo, composed of forty tons of foodstuffs, fuel, and lumber. As space is everything, both on shipboard and in journeys over the ice cap, every item in the provision line which can be had in a concentrated form has been chosen. Pemmican, the time-honored standby of hunter and explorer, is to be found there in abundance, with desiccated vegetables, condensed milk and soups, canned meats and fruits, and such like edibles. The list is varied and the supply is generous, for if an explorer must needs starve himself sometimes, when food grows scarce during a long sledge journey, there is all the more reason why he should fare well during his periods of rest and preparation. All these goods are packed in small square tins, which are in turn packed in specially prepared wooden boxes of uniform size. These all open at one end, and Peary has ingeniously contrived them so that he actually uses them for great bricks, so to speak, with which he builds his camps. When he determines on locating a permanent station at some point he has a number of these cases conveyed to the site and piled as a wall for his hut. A canvas roof is erected and fastened to the top tier, and the whole is then heavily banked up with snow, making the hut impervious to the biting blasts of the polar winter. As each case of food has its contents plainly stamped on the side which opens, and as they are all placed in position with this side facing the interior of the hut, a double purpose is served. The occupants have only to unscrew the end of a particular case to get at its contents, and a most convenient storehouse is assured with the exact quantity of foodstuffs available, a matter of merely a minute's observation. Petroleum is the fuel used, being the most portable as well as economical. It is carried in similar tins, and stored in the same way. For his dogs Peary annually shoots eighty or ninety walrus, the flesh of which, frozen into blocks, is carried along on the sledges and distributed, a cube to each animal, when a stopping place is reached. When a dog perishes it is cut up and distributed among the others, for Arctic canines cannot afford to develop any nice sensibilities on the score of food. Nor can Arctic explorers either, for that matter, as Peary and his men have on more than one occasion had to content themselves with a piece of raw dog meat, and thank fortune that they were able to get it and thus escape starvation.

These box-walled structures along Peary's route are both shelters and storehouses. He has boats also cached at each prominent headland, thus having the alternative of taking the water route when it is available. Fort Conger, the Greely station, is his most advanced post, for he has rendered it habitable again, and has liberally provisioned it against the demands of his great polar journey. With the same idea he has procured large numbers of dogs from the Eskimos, and has enlisted the services of ten of the most active and adventurous of the young men of the tribe to accompany him and his companions in the march to north, which is to be the crowning effort of his life work, and which may have been carried to a successful issue ere this.

This must properly be termed an over-ice journey, for the land ceases at Cape Joseph Henry, about the eighty-third parallel, and thence to the pole there is nothing save the vast crystal area, a counterpart of terra firma, as it were, with hills and valleys, plains and crags, the product of Nature's throes in this awe-inspiring region for countless ages. Travel over it is exceedingly difficult, and ten miles a day would be reckoned good work. It was over this surface that Nansen and Johansen toiled on their long and seemingly hopeless march five years ago, and it was in spite of apparently insuperable obstacles that they reached latitude 86° 14 minutes, a northing 1·70 miles beyond any competitor. Peary's plan is to break that record, at the least, and reach the pole if he can. Toward the attainment of the latter object, it is needless to say, he will strain every nerve, for he has planned and striven for this for ten long and weary years. His intimates are confident that he will succeed, though his maimed feet form a decided handicap; for they argue that he has shown such extraordinary energy and resolution in past journeys that he will overcome physical disabilities in the present instance, and make his way to the pole, even if he has to be hauled there on a sledge and at the last by the hands of his Eskimo servitors.

Even if these sanguine expectations should fail of realization, however, all who are conversant with his plans are satisfied that he will excel Nansen and plant the Stars and Stripes nearer the pole than any other national banner. The greatest auxiliary he will have toward that will be his Eskimos, who as dog-drivers are unequaled. No European or American comes anywhere near the natives as drivers of the half-wolfish canines which alone make traveling possible in that region, and by the utilization of eight or ten young "innuits" as assistants Peary increases very considerably his prospects of success. The work he has already done among these Eskimos has given them the greatest confidence in him, and the fact that he asks nobody to go where he will not venture himself tends to make

them follow him with an unquestioning fidelity which no previous explorer was ever able to win from them.

HAS THE POLE BEEN REACHED?

It is quite possible that Peary may have made this journey and returned from it ere the Windward reaches him. When he parted from her at Etah last August he established himself there for the Winter, intending to start north in March, traveling along the ice-foot to Fort Conger. He would take with him a large party of natives, with dog teams, to transport supplies to this advanced base, and as the round trip could be made in about fifteen days, two or three journeys were within their power if it required such in order to lay down at this outpost the stores he needed. From Fort Conger he would continue on, as the Spring advanced and the weather improved, to Cape Joseph Henry or Cape Hecla, the promontories which jut farthest into the open Polar Sea. He had never been as far as these headlands, and the conditions he would find he could not, of course, prognosticate, but the only one which would stop him would be an impassible precipice preventing access to the ice-floe beyond. But this is an unlikely circumstance, for he and his comrades are so expert in Arctic travel ere this that they can get anywhere to which an axe or explosive will open a way and that is bound to be at some point on the extensive face of land which fronts toward the pole.

On gaining a footing on the floe, Peary and his band were to make a dash toward the pole. A novel method had been devised by him for increasing the mobility of the expedition. All supplies would be taken from one sledge until its contents were exhausted, and then all its dogs save one or two being taken from it and added to the other teams, it and its conductor would be sent back to the cape, thus husbanding the supplies for those who continued on. Repeating the process until the ten Esquimos were dropped, Peary, Dederick, and Henson would venture the last stage alone. What degree of success they would attain it is impossible to conjecture, for an accident might cause the abandonment of the entire venture, if it did not, indeed, imperil the lives of all engaged in it. Peary hoped to advance for forty days and cover the same distance in twenty when returning, and he also expected to meet the Eskimos a few days' march from the cape, with supplies to eke out the scanty rations which the explorers must by that time have been reduced to.

If Peary has been able to carry out his plans as projected, and no disaster has befallen him on that far-off waste of ice, he should be able to embark on the "Windward" next month and return to civilization, from which he has now been two years absent. But if his plans have miscarried, he will probably remain north another year, unloading his supplies from the "Windward" and attempting another assault next spring. In that case, he would send back the ship, with his wife and child, and with reports as to his work the past year, she to return again next season. It may be, however, that the ship will be frozen in, and the world will be without news from him for another year, but that is unlikely, as she is manned with Newfoundlanders, who, from their lifelong experience of ice floes, have no equal as Arctic navigators.—Special correspondence New York Times.

Influence of the Temperature of Liquid Air on Bacteria.—Macfadyen has subjected cultures of various bacteria to the temperature of liquid air (—183° to —192° C.) for twenty hours. The cultures of the organisms were young and vigorous and were tested both on solid and on liquid media, viz., gelatin, agar, potato, and broth. The organisms used in the experiments were B. typhosus, B. coli communis, B. diphtheriæ, Spirillum choleræ asiaticæ, B. proteus vulgaris, B. acidi lactici, B. anthracis (sporing culture), Staphylococcus pyogenes aureus, B. phosphorescens, and Photobacterium balticum. After being taken out of the liquid air, the cultures were carefully thawed and examined. In no instance could any impairment of the vitality of the micro-organisms be detected. The fresh growths obtained by sub-culturing were normal in every respect, and the functional activities of the bacteria were equally unaffected. The colon bacillus curdled milk, fermented sugar, and formed indol, the Staphylococcus aureus retained its pigment-producing properties, anthrax its pathogenic action upon animals, and the phosphorescent organisms their luminosity. With regard to the latter, the cultures when cooled down became non-luminous, but on thawing the luminosity returned with unimpaired vigor. Plate cultivations made with liquid air itself gave colonies of the ordinary forms met with in air. (Proc. Roy. Soc. Lond., vol. 66, February 1, 1900.) Further experiments by Macfadyen and Rowland confirm the foregoing results, but the test was more severe. ("Roy. Soc. Paper," April 5, 1900., Lancet, 1900, I., p. 1,130.) Cultures of the various organisms mentioned above, and also a sarcina, a yeast, and unsterilized milk were placed in a broth emulsion in fine quill tubing hermetically sealed. These were immersed in the liquid air, which, as before, was supplied by Professor Dewar, and a temperature of about —190° C. maintained uninterruptedly for seven days. Notwithstanding the enormous mechanical strain to which the organisms must have been subjected, not the slightest structural alteration could be detected, and their vitality and biological characters were unimpaired and unaltered. It is hoped at a future date to undertake experiments with liquid hydrogen.

MATÉ, OR PARAGUAY TEA.

MATÉ, or Paraguay tea, an infusion of Ilex paraguayensis, would seem to have certain advantages over tea proper, says Dr. James W. Allan in some remarks made at a recent meeting of the Glasgow Southern Medical Society and reported in The Glasgow Medical Journal for June. While it is a stimulant containing an active paincipie analogous to theine and caffeine, it is said not to interfere with the digestion of meat, or to prevent sleep. It is made from the leaves and branches of the plant, in the same manner as ordinary tea, but, containing much less tannin, is not harmed by boiling. Dr. Allan states that the taste for maté tea is an acquired one, but surely so is that for tea or coffee. If that is the only objection to it, its supposed advantages might entitle it to a trial.—N. Y. Medical Journal.

TRADE NOTES AND RECEIPTS.

Scalp Wash.—Mix 2 parts of soap spirit, 1 part of borax-glycerin (1 + 2), 6 parts of barium, and 7 parts of orange-flower water.—Oesterreichische Drogisten Zeitung.

Hair Curling Essence.—

Potash	7 parts.
Spirit of sal-ammoniac	3·5 "
Glycerin	15·0 "
Alcohol	42·0 "
Rose water	550·0 "

—Pharmaceutical Zeitung.

Purifying Rancid Castor Oil.—To clean rancid castor oil, mix 100 kilogrammes of the oil at 28° Réaumur (95° F.) with a mixture of 1 kilogramme of alcohol (96 per cent.) and 1 kilogramme of English sulphuric acid. Allow to settle till the end of the next day and carefully separate from the precipitate. Now wash with warm water, boiling for one-half hour; allow to settle for twenty-four hours in well closed vessels, after which time the purified oil may be taken off.—Giornale de Farmacia through Seifensieder Zeitung.

Modeling wax for dentists is produced as follows, according to Zahntechnische Reform:

Yellow wax	16 parts.
Wheat starch	8 "
Venetian turpentine	4 "
Olive oil	1 "
Venetian red	1 "

Melt the wax, oil, and oil of turpentine at a pretty low temperature, and add to the molten mass the starch, as well as the olive oil and the dyestuff.

Indelible Labels on Bottles.—To affix indelible labels on bottles an etching liquid is employed which is produced as follows:

Liquid I, in one bottle.—Dissolve 36 grammes of sodium fluoride in ½ liter of distilled water and add 7 grammes of potassium sulphate.

Liquid II, in another bottle.—Dissolve zinc chloride, 14 grammes, in ½ liter of distillod water and add 65 grammes of concentrated hydrochloric acid.

For use mix equal parts together and add a little dissolved India ink to render the writing more visible.

The mixing cannot, however, be conducted in a vessel. It is best to use a cube of paraffin which has been hollowed out.—Zeitschrift fur die Gesammte Kohlensaure Industrie.

Useful Solutions for Domestic Batteries.—The almost exclusively employed solution of sal-ammoniac (ammonium chloride) presents the drawback that the zinc rods, glasses etc., after a short use, become covered with a fine, yellow, very difficultly soluble, basic zinc salt, whereby the generation of the electric current is impaired and finally arrested altogether. This evil I tried to meet by an admixture of cane sugar, and after having employed it for years I am convinced of its usefulness. For a battery of ordinary size about 20 to 25 grammes of sugar, dissolved in warm water, is sufficient per 50 to 60 grammes of sal-ammoniac. After prolonged use only large crystals (of a zinc saccharate) form, which, however, becomes attached only to the zinc rod in a few places, having very little disadvantageous effect upon the action of the batteries and being easy to remove owing to their ready solubility.—Neueste Erfindungen und Erfahrungen.

Production of Eau de Cologne.—The Deutsche Drogisten Zeitung is authority for the following recipe of an excellent tried eau de cologne:

Dissolve in 23 kilos of best spirit of wine (95 per cent.):

Lemon oil	350 grammes.
Bergamot oil	270 "
Lavender oil, best French	20 "
Peppermint oil	12 "
Acetic ether	12 "
Neroli oil	120 drops.
Thyme oil, best French	100 "
Rosemary oil, best French	110 "
Rose oil	20 "

After a few days add:

Orange-flowers water, triple	1·100 kilo.
Rose water, triple	0·200 "

The composition gives an excellent imitation of the popular product of J. M. Farina, gegenüber den Jülichsplatz. If the predominating rosemary odor is not liked in it, the quantity of the respective oil may be decreased. After three months' storing an addition of 5 to 7½ kilos of spirit of wine to the whole amount is necessary, whereupon it is stored another three months, before being sold. Eau de cologne really ought to be sold only after one year's storing; even less happily chosen compositions yield them pretty good varieties.

Process for the Preparation of Hydrates of Sodium Bioxide and their Employment.—In a closed space, and preferably at a temperature of 15° C., kept moist (saturated completely or not with watery vapor), the author places the sodium spread in a thin layer (about one centimeter thick) on plates of glass or porcelain. This layer is stirred from time to time until the degree of hydration wished for is secured, which is ascertained either by weighing the product before and after, or by titration. The hydration is extended to eight molecules of water, and even more, for one molecule of sodium bioxide, but the hydration may be stopped below the limit so as to obtain intermediate hydrates. According to the author, the hydrates of sodium bioxide advantageously replace in all respects either oxygenized water or sodium bioxide or other metallic bioxides in oxidations in general, and particularly in bleaching, of which we cite herewith a sample communicated to us.

Bleaching of Wool.—The bath is made of 100 liters of water, 2,220 grammes of hydrate of sodium bioxide and 1,079 grammes of concentrated sulphuric acid. The bath obtained is supposed to be neutral; if acid, it is rendered slightly alkaline by the addition of ammonia. The wool to be bleached, previously cleaned and freed from grease, is then introduced, and while being constantly stirred, the temperature is raised to 50° C. at most. In a few hours it is washed with plenty of water, which terminates the operation.—M. Joubert. Translated from La Revue des Produits Chimiques.

SELECTED FORMULÆ.

To Stop Leakage in Iron Hot Water Pipes.—Take some fine iron borings or filings and mix with them sufficient vinegar to form a sort of paste, though the mixture is not adhesive. With this mixture fill up the cracks where the leakage is found, having previously dried the pipe. It must be kept dry until the paste has become quite hard. If an iron pipe should burst, or there should be a hole broken into it by accident, a piece of iron may be securely fastened over it, by bedding it on in paste made of the borings and vinegar as above, but the pipe should not be disturbed until it has become perfectly dry.

Pumillo Toilet Vinegar.—

Alcohol, 80 per cent	1600 parts.
Vinegar, 10 per cent	840 "
Oil of pinus pumillo	44 "
Oil of lavender	4 "
Oil of lemon	2 "
Oil of bergamot	2 "

Dissolve the oils in the alcohol, add the vinegar, let stand for a week and filter.

Liquid Bronze.—Under this name the Papier Zeitung gives a formula for a liquid, which, while it contains no metallic constituent, yet possesses a metallic luster and a bronze appearance, and answers excellently for many purposes. This formula is as follows: Dissolve by the aid of gentle heat 10 parts of anilin red and 5 parts of anilin purple in 100 parts of alcohol. When solution is complete, add 5 parts of benzoic acid, raise the heat, and let boil from 5 to 10 minutes, or until the greenish color of the mixture passes over to a clear bronze brown. For "marbling" or bronzing paper articles, this answers particularly well.

Cucumber Cream.—

1. White Wax	3 ounces.
Spermaceti	3 "
Benzoinated lard	8 "
Cucumbers	3 "

Melt together the wax, spermaceti and lard, and infuse in the liquid the cucumbers previously grated. Allow to cool, stirring well, let stand a day, remelt, strain and again stir the "cream" until cold.

2. Benzoinated lard	5 ounces.
Suet	3 "
Cucumber juice	10 "

Proceed as in making cold cream.

Cherry Tooth Paste.—

Clarified honey	225 grammes.
Precipitated chalk	225 "
Powdered orris root	225 "
Powdered rose leaves	28 drops.
Oil of cloves	30 "
Oil of mace	30 "
Oil of geranium	30 "

Tooth Soap.—

Castile soap	225 grammes.
Precipitated chalk	225 "
Powdered orris root	225 "
White sugar	112 "
Rose water	112 "
Oil of cloves	60 drops.
Oil of peppermint	7 grammes.

Stencil Ink.—

Shellac	2 ounces.
Borax	2 "
Acacia	2 "
Water, a sufficient quantity	

Boil the shellac and borax together with sufficient water to effect solution; then add the gum and sufficient lampblack or other pigment to give the desired color. The thickness of the ink is regulated by the amount of water used, of course.

To Bleach Sponges—Sponges may be bleached by the following procedure. Prepare two solutions according to the appended formulas:

1. Potassium permanganate	25 grammes.
Pure water	1 pint.
2. Sodium hyposulphite	2 ounces.
Hydrochloric acid	1 ounce.
Water	1 pint.

Dissolve the hyposulphite in the water, add the acid, let stand 24 hours and decant from the sediment. The solution should be made in the open air, care being taken not to inhale the fumes that arise.

Free the sponges from sand and other extraneous matter first by beating and then washing thoroughly with water. Squeeze them as dry as possible and then immerse them in the solution of permanganate, allowing them to remain in the liquid a few moments, or until they acquire a dark-brown color. After removal from this solution, dip the sponges, a few at a time, into the hyposulphite preparation, allow them to become thoroughly saturated, and then remove and wash in water until the odor of the solution is entirely removed. Squeeze out, and when nearly dry, immerse in a solution of ½ ounce of glycerin to 1 pint of water, and finally dry in the shade.

Care should be taken not to expose the sponges to the action of either bath longer than is actually necessary to effect the desired object. While the substance of the sponge is said to be slightly affected, if at all, by this treatment, prolonged exposure will be injurious.

Another method recommended by Roeser is to first wash the sponges with warm water containing in each liter 20 drops of a 10 per cent. solution of caustic soda; then rinse them in warm water so as to wash out everything soluble in that liquid. The temperature of the water should be from 104° to 110° F.

Press the water from the sponges and then immerse them without squeezing, in dilute bromine water, prepared by adding to each liter of warm water 30 grammes of a saturated aqueous solution of bromine. Leave the sponges in this liquid until they are partly decolorized, then remove them, press, and repeat the treatment once or twice with fresh bromine water until they are rendered as white as desired or possible. Next immerse in warm water rendered slightly alkaline with caustic soda (say 20 drops of a 10 per cent. solution to each liter of water), and lastly wash thoroughly in pure water.—Druggists' Circular.

TRADE SUGGESTIONS FROM UNITED STATES CONSULS.

Waterworks at Moscow.—Consul Smith, of Moscow, under date of June 23, 1900, says:

The Moscow municipality has been granted by the Government the privilege of issuing a loan to the extent of 14,000,000 rubles ($7,000,000), for the purpose of enlarging the capacity of the Moscow waterworks. The population of this city is increasing rapidly, and on that account the water-supply question has become a serious matter, requiring immediate attention. The loan was granted in consequence of a water famine, which occurred a month ago and lasted about five days, through a breakage of the main supply pipe at the connections near the waterworks. Foreign manufacturers are invited to make bids for contracts in supplying machinery, etc.

Soap Trade in Mannheim.—Consul Harris writes from Mannheim, June 22, 1900:

The Sunlight Soap Company, an English concern, has completed a large plant at Rheinau, a suburb of this city, for the manufacture of laundry and other soaps for domestic use. The building is about 600 feet long and is well equipped with machinery for soap making, and with printing offices and other facilities for preparing advertising matter. The company is one of the largest advertisers in this locality and has for some time practically controlled the soap trade in the surrounding towns and villages. No American soap is sold here, so far as I know. As Mannheim and its suburban villages have a population of nearly or quite 225,000, largely engaged in manufacturing and in railroading, the district would seem to offer a good field for our own trade in this line. Mannheim is a center of distribution for petroleum and many other products. The fact also that this locality exports very largely to the United States (nearly $4,500,000 per year) removes much of the hostility that might otherwise exist against our goods.

Lighting Cities in Haiti.—Minister Powell under date of Port au Prince, July 4, 1900, informs the Department that the Haitien Government has concluded to furnish light to its cities, and in future not to grant concessions for this work to others. The Government will cancel all concessions and pay the holders for their plant and for such amounts as have been expended by them. The Government also promises to introduce a system of electric lights for the capital in the early fall.

Pearl Growing in Japan.—Consul Marshal Halstead sends from Birmingham, July 16, 1900, a clipping from The London Daily Mail embodying a dispatch from a correspondent at Tokyo, Japan, as follows:

WHERE PEARL GROWING PAYS.

Artificial pearl growing is a new industry lately started by Mr. Kokichi Mikimoto, in Miye prefecture. The extent of his success in this enterprise may be calculated by the following incident:

Taking advantage of the presence of the Crown Prince and Princess at Ise on June 25, Mr. Mikimoto submitted, through Mr. Ogura, prefectural governor, twenty-seven pearls of various sizes, the products of his pearl bed, for the inspection of their highnesses.

The Crown Prince was, it is said, so highly pleased with the beautiful gems that he bought up the whole twenty-seven, which were priced from 5 to 100 yen ($2.49 to $49.80) each.

Trade Marks in Denmark.—I deem it of importance to American exporters to Denmark to direct their attention to the trade mark laws of this country, says J. C. Ingersoll, Consul at Copenhagen. Under the Danish law a trade mark is granted four months from the date of filing the application, but any person having already registered a similar trade mark in another country may apply here and the mark will be registered here in the name of the person to whom such trade mark has been granted, the registration upon behalf of the Danish applicant being refused.

The American manufacturer whose trade mark has not been registered here runs the risk of having it taken away from him by any unscrupulous person who intends to put an imitation of American goods upon this market.

A large firm of English pickle makers has lately been compelled by reason of neglect in this matter of trade mark registration to materially modify its old trade mark of St. George and the Dragon, because that saint and that dragon had been appropriated by a Danish firm making a liquid dentifrice. The popularity of American goods in this country grows daily, and American manufacturers will avoid much trouble and expense by registering without delay.

Electric Fans and Soda-water Fountains in England.—The heat wave in London has created an opening for electric fans, says Consul Marshal Halstead, of Birmingham. The Daily Mail says that London is the most backward of all great capitals in provision for meeting heat.

Although "suction" ventilating fans, driven by electricity, are quite well known, I have never seen an electric fan of the cooling type in use in England. I wonder why our manufacturers in this line neglect their opportunity here.

The Mail adds:

"But there is one American summer cooler that is at last getting a foothold here. Ice-cream soda, the most delicious and refreshing of all beverages, is making its way. A few weeks back, several soda fountains were placed in chemists' shops here. For a time the London public did not properly appreciate them. A Holborn druggist at first reported that his sole patrons were American passers-by; but now he cannot manufacture the drink fast enough to supply the demand."

It has been a surprise to me that the soda-water people have never taken Great Britain in hand. A chemist (druggist) told me the other day he had some friends who had lived in the United States, and even worked at soda fountains there, and from their statements he was very anxious to put in a soda fountain. He had written to a firm in London representing an American soda-fountain manufacturer, but it replied that the cheapest fountain would cost 100 guineas ($510.98), and intimated that the necessary accessories would be expensive. The matter was dropped. If an enthusiastic salesman had visited him the next day, had offered good terms, had explained the working details and promised to be on hand the first week of the fountain's operation, he would have sold a fountain, and the seed sown would later have borne good fruit. Another chemist has asked me for the address of a good soda-fountain manufacturer. These two instances indicate the possibilities in this branch of trade.

Street Roller and Petroleum Engines Wanted in Beirut.—The streets of Beirut are in a deplorable condition, and extensive improvements are contemplated. The small rollers used at present are drawn by eight or ten mules and are found inadequate and very difficult to manage on the narrow streets, some of which are less than 20 feet wide. Bids are now wanted on a roller (steam) weighing from 11 to 14 tons and capable of working on an incline of 5 per cent. The machine should be so constructed that the weight can be increased or diminished. I understand, says William C. Magelssen, Vice-Consul at Beirut, a steam roller has recently been purchased by the municipality from England, costing about £380 ($1,849). The negotiations for this machine were, however, completed before the rise in the price of iron.

The idea is now to purchase a similar machine from the United States and test it thoroughly. Future orders may be hoped for if it should prove satisfactory. Prices should be c. i. f. Beirut and bids should be sent to Messrs. H. Sabbag & Fils, Beirut, who have agreed to furnish the municipality with all necessary information regarding American steam street rollers. Bidders at home should lose no time in putting themselves in communication with Messrs. Sabbag.

Mr. Michel J. Nasser informs me that he would be glad to open correspondence with manufacturers of petroleum engines for irrigation purposes. He desires lowest prices on engines of from 1 to 5 horse power, with cost of operating the engine and amount of oil consumed when run twelve hours per day. These engines have found quite a market in the neighboring city of Haifa, but they are all German manufacture.

Mr. Michel J. Nasser is a commission agent of Beirut, Syria, and is taking much interest in American goods.

Industries of Sault Ste. Marie.—The industries of Sault Ste. Marie are rapidly becoming important. There are on the Canadian side of Sault Ste. Marie the Algoma Commercial Company, the Canadian Steel Company, the Sault Ste. Marie Pulp and Paper Company, and the Lake Superior Power Company.

American power companies are supplying power to the numerous companies above mentioned, and are also supplying the city of Sault Ste. Marie with both electric and water power. They have at the present time a capacity for developing 16,800 horse power by forty-two turbine wheels of 400 horse power each. The intention is to construct an additional one of much larger capacity in the near future The pulp company is turning out 150 tons of pulp per day, practically all of which goes to France, Germany, and England. The managers have a large sulphide plant under construction, which will be finished in a very few weeks, and have an output of 75 tons of chemical pulp per day. They also have very large iron works and manufacture a great deal of their machinery, including many electric appliances; and they have made in their works the iron columns for their new buildings. They have also under way smelting works for the manufacture of pig iron, and with the addition of the nickel ore received from their own mines at Sudbury, will make "ferro-nickel pig."

These companies also control on the American side of Sault Ste. Marie, Mich., the Lake Superior Power Company, the Union Carbide Company, and the Michigan Reduction Company.

They are constructing a canal on the Michigan side and water-power works which will contain three hundred and sixty turbine wheels with a capacity of 125 horse power each. The capitalization is $3,500,000, and the works will cost that when completed. The water power on the Michigan side will also be used to run factories similar to those now on the Canadian side, with a carbide mill and an alkali factory in addition. The product of the carbide mill is owned by the Carbide Company, of Chicago, and the product of the alkali factory by the American Alkali Company, of Philadelphia.—Charles E. Turner, Consul-General at Ottawa.

Flour Mills in Para.—Consul Kennedy writes from Para, July 17, 1900:

A movement is in progress, backed by foreign capitalists—principally French—to erect a gigantic flour mill here. The location is reported to have been selected, and the building will be completed not later than March 31, 1901. The erection of this mill in Para will be keenly felt by American manufacturers of flour who are marketing their surplus in the Amazon Valley, though our exporters may still be able to supply the grain. More important still is the reported formation of a syndicate, composed chiefly of Europeans, for the purpose of erecting a flour mill, a saw mill, and a sugar mill combined, the enterprise to be known as the Para and Amazon Valley Milling Company. The entire outfit, I am informed, will be purchased in the United States, and an experienced American will be employed to superintend the erection of the mill. Dr. Bolhona will doubtless be selected to visit the United States with a view to completing arrangements.

Textile Industry Enlargements in Austria.—The cotton textile business in Austria having been very prosperous in 1899, and the present year promising equally satisfactory results, many noteworthy enlargements of existing factories and building of new ones are just completed, under way, or projected. Some 8,000 cotton looms will be added this year to the number in operation. The product of the spinning factories is also being increased to meet the augmented demand from the weaving machines. In Bohemia alone the number of spindles will be increased by 150,000, which will produce per annum about $2,000,000 worth of cotton yarn. As Austria has been importing cotton yarn to nearly that value, there is evidently occupation for the new spindles, even should the expectations of increased weaving be disappointed. It is probable, however, that the existing uncertain state of the cotton market, had it appeared sooner, would have checked these improvements; but they have now gone too far to annul the plans therefor.

There is also marked, though not as great, activity in woolen and linen circles in the direction of extensions and new factories. In both these lines of industry business has been unusually large during the past eighteen months, though profits have relatively declined; but to hold the trade it is found necessary to increase facilities for production, hence the activity here noted, which is specially marked in Northern Bohemia.—Frank W. Mahin, Consul at Reichenberg.

Diamonds in British Guiana.—It has been known for many years that diamonds exist in this colony. In 1890 749 stones, weighing in the aggregate 514·53 grains, were discovered.

The colonial commissioner of mines, in his official report in 1893, alluded to the finding of diamonds in the different gold placers, and expressed a belief that diamond mines would ultimately be found. Up to that time, the largest stone found weighed 8 grains.

Last March 282 stones were found 250 miles up the Mazaruni River. They were sent to London, where they were examined and the lot valued at $12 per carat.

Recently 400 small stones were brought down from the same locality. They were washed out by nine men in eighteen days by very crude methods. The stones are octahedron, varying in weight from a decimal of a grain to a carat and a half in the crude state.

London dealers consider the stones superior to South African diamonds, and value them 25 to 50 per cent. higher than those found in that region, and they pronounce them equal in quality to Brazilian stones.

The distance from Bartica, at the confluence of the Essequibo and the Mazaruni rivers, to the locality is 250 miles. The diggings are about 5 miles from the river, over a narrow trail through a tropical jungle. Provisions and materials are packed on men's backs and thus conveyed to the vicinity.

It requires eight days to make the journey up. The return voyage, which is both exciting and dangerous, is accomplished in two days and a half.

A concession of 2,000 acres of land in the locality has been granted to Messrs. Conrad & Gilkes, of this city, for the purpose of mining precious stones. Other local parties have recently contributed money to send an experienced diamond miner with twelve men to the district, who will endeavor to locate the matrix from which it is thought the stones already discovered came.—George H. Moulton, Consul at Demerara.

Electrical Power at Kiel.—Consul-General Guenther writes from Frankfort, July 14, 1900:

Steam power is to be superseded by electricity to a very considerable extent in the government dock yard at Kiel, Germany. After experimenting with electrical power transmission on a comparatively small scale, the administration has now decided upon a bolder scheme, whereby all the machine tools, etc., installed in the different workshops are to be electrically driven. To this end, a power plant having a capacity of 3,500 horse power is to be erected. This plant will also supply electrical energy for driving the powerful dock-yard pumps.

British Electrical Experts at Paris.—Under date of Birmingham, July 13, 1900, Consul Marshal Halstead reports that at the annual general meeting of the Electric Construction Company, in London, the chairman announced that the company had sent to Paris, at a moderate expense, over twenty leading employes, in order that they might see in the Exposition what is being done in the electric machinery world abroad.

Horse Power of Machinery at Paris Expositions.—Under date of July 14, 1900, Consul-General Guenther, of Frankfort, says:

The modern demand for high power machinery is shown by a comparison of the machinery exhibited at the last four world's expositions at Paris. In 1867 there were exhibited and operated 52 machines, with an aggregate of 854 horse power; in 1878, 41 machines, aggregating 2,533 horse power; in 1889, 32 machines, with 5,320 horse power; and in 1900, 37 machines, with 36,085 horse power. The average horse power per machine exhibited in 1867 was 16; in 1878, 62; in 1889, 170; and in 1900, 973—a most startling increase. France this year exhibits and operates 18 machines, with an aggregate of 14,435 and an average of 802 horse power. Other countries operate 19 machines, with 21,650, or an average of 1,140 horse power.

Gold and Platinum in Russia.—Vice-Consul-General Hanauer, of Frankfort, under date of July 23, 1900, writes:

There are now but four works in the Ural region of Russia where gold is obtained by means of chemical process. The former gold mines, having given out, are not worked any more. While the world's annual gold production has increased 16·3 per cent. during the last decade, that of Russia has remained as before, amounting to about 2,400 poods (86,668 pounds) yearly. But platinum, of which the Ural Mountains furnish 95 per cent. of all of the world's supply, has increased both in quantity and value. The amount of this metal produced in the Ural region in 1899 was 13,242 pounds, against but 6,363 pounds in 1890.

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GEROME'S "CÆSAR CROSSING THE RUBICON."

GEROME, the sculptor, has recently added a new equestrian statue to the series of sculptures of great military personalities begun by him a few years ago.

CÆSAR CROSSING THE RUBICON.—BY GEROME.

It is Cæsar crossing the Rubicon and thus affirming his resolution to march upon Rome at the head of his army, after having uttered the memorable words "jacta alea esto." Let us recall this incident in a few words.

Julius Cæsar, the conqueror of the Gauls, and who fifty-one years before Christ pacified the country after incessant conquests, claimed as a reward from Rome the honor of the consulate. It was then that the intrigues of Pompey, who was jealous of his rival's success, were the cause not only of the title of consul being refused by the Senate, but also of the latter's order to the conqueror immediately to abandon his army under the penalty of being declared a traitor to his country.

Cæsar, who was beloved by his soldiers, cleverly profited by the bad impression made upon them by the publicity given to this sanatus consultus, to avenge, through them, the injury done him, which was so much the greater in that the order of disgrace named, at the same time, Pompey as generalissimo of the troops of the Republic.

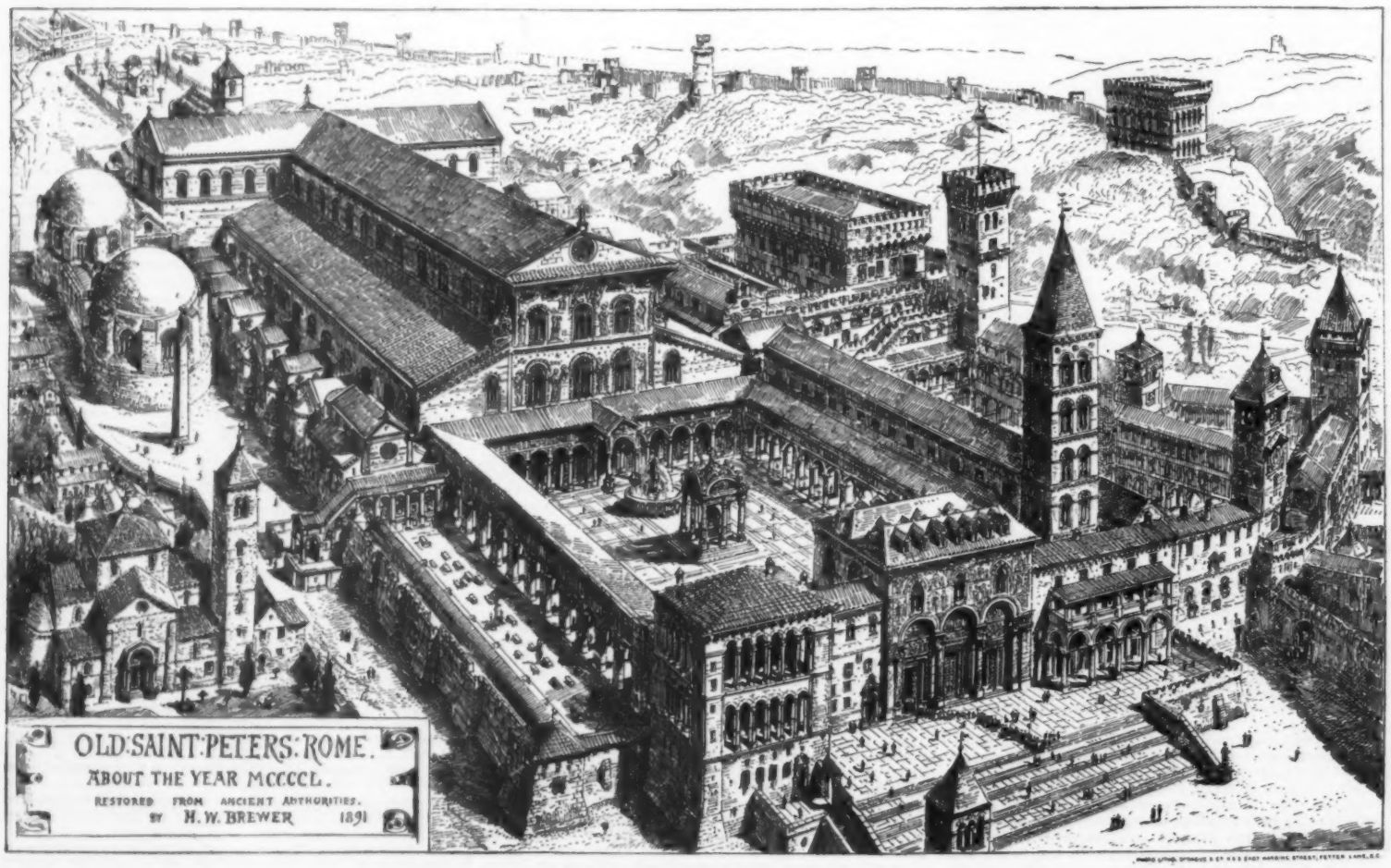
In his previous productions, Gerome has adopted a quiet motion for the step of his horses, along with the attitude best befitting the conditions of equilibrium necessary for a representation honoring a person of quality. In the work under consideration, the movement is more pronounced. The two feet of the hind quarters of the animal are still in the water, while the forelegs are beginning to climb the bank with a certain effort, and the wind, which is blowing in a tempest, violently animates the accessories so as to set off the subject very picturesquely. The horseman has the thoughtful face of a man who has just taken a great resolution, of which he accepts the consequences. His body, bent forward, identifies itself with the ascensional movement of the animal, whose hind foot is about to leave the ground in order to follow diagonally in the normal order, the right fore foot, which clings firmly to the acclivity.

As in all the compositions of the artist, the details of this expressive group are treated with a care which characterizes an accuracy that leaves no doubt as to the truth of Gerome's work in its sculptural ensemble. —For the above particulars and the engraving, we are indebted to Le Megasin Pittoresque.

OLD ST. PETER'S, ROME.

GRAND as the modern Vatican Basilica undoubtedly is, yet the archæologist and historian must always regret that the ancient church, the site of which it occupies, has so entirely disappeared. When one contemplates the fact that down to within four centuries of our own times there existed a vast complete ecclesiastical edifice of the age of Constantine very slightly altered from what that Emperor left it, a building which preserved all the main characteristics of its original design—the largest ancient church of early Christian times—no architectural splendor, not even Michelangelo's glorious dome, can compensate for its loss.

It is remarkable that all through the Middle Ages, down to the dawn of the Renaissance, it never seems to have entered into the minds of the Pontiffs to rebuild the old Vatican Basilica; even the glories of Venice, Milan, and Florence, to say nothing of the noble Gothic cathedrals of the north, could not tempt them to rebuild the great rude and somewhat barbarously constructed old building. Of course, various minor alterations and additions took place from time to time in the ancient Basilica, but the main fabric remained whole and entire, as it had been constructed by Constantine, certainly down to the time of Nicholas V. This Pontiff has usually been accredited with the idea of the erection of the modern St. Peter's Church, but there does not really appear to be any warrant for the statement. Undoubtedly in the time of Nicholas V., the old Basilica, which had been hastily constructed, and to a large extent from the materials of old classical buildings, had become decayed and the apse or tribune may have fallen down, and Nicholas V. had called in the celebrated architects, Leo Battista Alberti and Carlo Rosellino, who seem to have drawn up a report upon the condition of the building; what else they did is very doubtful. Either, however, in the time of Nicholas V. (1447–1455) or shortly after, the great transept of the church was pulled down, the altars, monuments, and other objects of art which it



OLD SAINT PETER'S, ROME.

contained, being rebuilt in the nave, evidently with the intention of replacing them in their original situations when the work of restoration or rebuilding had been completed.

That this work was partially, if not wholly, carried out, is quite certain, because, on the reverse of a medal struck by Paul V. the tribune is shown with a semi-dome above it, inlaid with Mosaic, and a great baldachino of a simple form below it. Evidently the whole thing was an attempt to reconstruct the old tribune.

In the center of the eastern front of the quadriporticus stood the great entrance gateway with three bronze doors. The arches and columns appear to have been Constantine's work, but the upper portion was covered with Mosaic work and Gothic windows introduced during the fourteenth century. To the north of this was open loggia. Immediately behind rose the lofty companile. It stood four stones high above the roof of the quadriporticus and in each story were eight two-light windows with double columns and Gothic tracery. It was built by Leo IV. in 1308. It was struck by lightning in 1333 and the bells melted.

In front of the entrance gate was a platform approached by an immense wide flight of steps subdivided into five sets, each consisting of seven steps. Passing through the gate we should have found in the center of the courtyard the great "Pigna," or pine cone from the mausoleum of Hadrian preserved beneath an elaborate Gothic baldachino.

The great east front of the church itself had been covered with Mosaics and its windows filled with Gothic tracery in the fourteenth century. The church consisted of a long and very wide nave with four aisles. The clear story was supported by forty-six columns, twenty-three on a side. The transept was not arranged as in Gothic churches, but formed a transverse nave at right-angles to the principal one, so that there was no crossing. The great apse or tribune opened from the west side of the transept by a large arch. To the west of the great apse was a lady chapel, really forming a complete little basilica having its vane, aisle, apse, and companile.

The old Basilica of St. Peter's was surrounded by chapels and churches. The small staircase at the left of the entrance to the church was used by the Popes when they lived at the Palace of the Lateran, in connection with a small robing room. At the extreme left will be noticed two curious buildings with large rotundas. Their origin is obscure. In front is the old obelisk. It is possible that all three were on the spina of the old circus of Nero. The Campo Santo was across a narrow street and at the lower left hand corner is the church erected by Charlemagne. On the right hand side will be noticed the old buildings of the Vatican. Nothing now remains of an earlier date than Nicholas V. except possibly the external walls of the Sistine Chapel.

For our engraving and the foregoing particulars we are indebted to The Builder.

Cleaning Agent for Rusty Rifles.—Same consists of vaseline oil, 4 parts; French turpentine, 1 part, and naphtha, 1 part. It is sufficient to thoroughly saturate the oakum wrapped around the wad-hook with this mixture and to wipe the interior of the barrels a few times. Next, rub the barrel stock and system externally with a moistened brush and wipe the rifle clean with a rag.—Süddeutsche Apotheker Zeitung.

THE PANORAMAS OF THE PARIS EXPOSITION.

WE have passed in review two kinds of animated panoramas,* in one of which the spectator is upon the sea, and in the other upon a railroad. In order to complete the series of the modes of conveyance, we now have to speak of the balloon. Here, also, we find motion and color, but there is no mechanism to actuate a back canvas, since the latter does not exist. The circular image that surrounds us is fugitive. It is a projection, and, what is more, a cinematographic one.

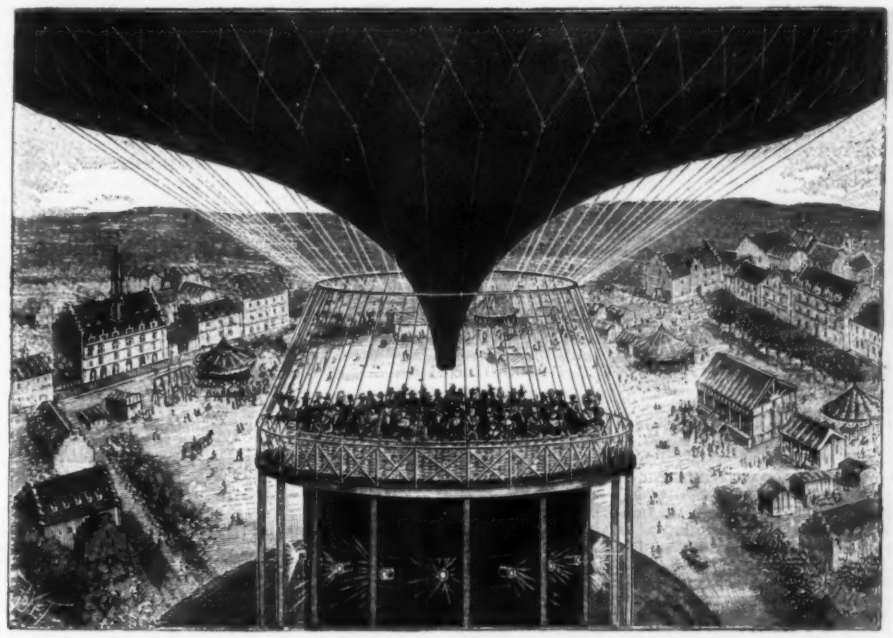


FIG. 2.—BALLOON CINEORAMA—GENERAL VIEW OF THE INTERIOR.

We have already had occasion to speak of panoramic projection. A Mr. Chase materialized the idea at Chicago, and Colonel Moessart, in a lecture delivered at the Conservatoire des Arts et Metiers, accompanied with experiments, has again shown us that it is possible. In order to obtain a panorama of this kind there are employed several negatives (six at a minimum) projected one alongside of another upon a circular, or better, a polygonal screen, by as many lanterns. The whole difficulty resides in the connection of the images with each other, in such a way that the junction shall not be visible. In the first place, the transparency of the negatives must be sensibly the same and the light of each lantern must have the same intensity. Care must be taken to have on the edge of each negative a portion of a landscape common to each, and which, in the projection, must be exactly superposed. The field to be lighted upon each negative must be exactly limited by means of windows of variable and regulatable dimensions.

It will be understood that, at the place of junction, the illumination is not exactly the same as in the rest of the image, since two lanterns and two negatives concur in this part of the projection. This may be corrected by arranging small opaque screens between the source of light and the condenser. We thus obtain penumbras of a degraded tone which unite and render the junction invisible.

Although the problem of projection was of easy solution, there was, as has just been seen, some difficulty in the way of regulation. M. Grimoin-Sanson, a French engineer, has boldly attacked a much greater difficulty, in the way of projecting the movable negative of the cinematograph, instead of stationary negatives.

In principle, it was a question of taking the panorama that unwinds before the eyes of the travelers, at the moment of ascension, by means of ten apparatus arranged upon a fixed circular table, and of afterward projecting the ten cinematographic views thus obtained upon the walls of a circular hall.

In order to begin, views are taken by placing the apparatus in the middle of a public square, for example. This apparatus (Fig. 1) consists of a stand 8·25 feet in height supporting a circular table 5 feet in diameter, around the periphery of which are placed ten cinematographs. We shall not describe the mechanism of these at present, but shall be content to say that in them are employed sensitized bands 196·8 feet in length and 2·8 inches in width. These bands are perforated at the sides, and the images are 2·2 inches in width by 2 in height. The motive shaft of each apparatus terminates in a toothed pinion situated upon the side opposite that which carries the objective. When the ten apparatus are in place, all these pinions engage with a horizontal toothed wheel fixed to the center of the table, and the axle of which, terminating in a winch, ends in the interior of the support at such a height that it can be easily maneuvered by three men standing at the sides. It will be seen that under such conditions the ten apparatus operate synchronously. The objectives are calculated for embracing an angle a little greater than 56 degrees, so that there shall be one part in common upon the edge of each image. The windows that limit the width of the latter are regulatable by means of micrometric screws, and in this way the dimensions of the common parts may be exactly determined.

After some interesting animated panoramas had been taken on terra firma in different countries by means of this apparatus, it was resolved to carry it up in a balloon. It weighs 1,100 pounds, and its volume

FIG. 1.—THE GRIMOIN-SANSON APPARATUS FOR TAKING CINEMATOGRAPHIC PANORAMAS.

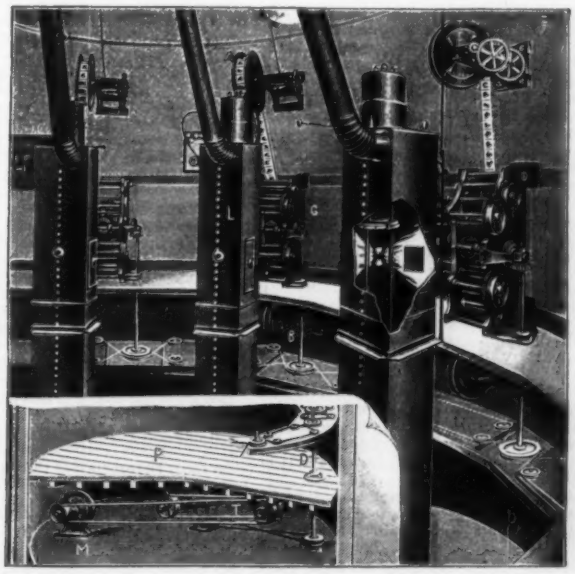


FIG. 3.—DETAILS OF THE INSTALLATION OF TEN PROJECTION APPARATUS AND THEIR ARC LAMPS.

* SUPPLEMENT No. 1285, page 20602.

occupied the larger part of the car in which it was placed. The start took place at the Tuileries at the beginning of May, at a time when the weather was slightly cloudy. As soon as the order to "let go" was given, the apparatus was set in operation and kept in motion until the balloon had reached a height of 1,300 feet.

The cinematopanoramic negative thus obtained was a great success, and the spectators before whom it was projected had the sensation of rising in the air. Since the apparatus is reversible, it suffices to cause the band to move in an opposite direction in order afterward to give the sensation of descending earthward. For the projection of the positive bands, there has been constructed a polygonal hall 10 feet in diameter (Fig. 2), the walls of which are formed of six screens 30 feet in height and 30·5 in width. To the spectator, these seem to form one continuous circular screen. In the center there is a circular chamber of protected cement, 14·75 feet in height and 13 in diameter. Over this chamber is laid the floor upon which the spectators stand, and above the head of the latter an immense canvas provided with netting and secured to the top of the wall represents the balloon that is supposed to carry them into space. The chamber is provided with ten apertures through which pass the objectives of the ten projection apparatus. The latter are arranged upon a circular shelf, and behind each of them is placed a 30 ampere arc lamp. In order to prevent an excessive heat, which would discommode the operators, each lamp is enclosed in an iron plate box provided with a chimney that carries the hot air to the center of the chamber, whence a pipe leads it to the exterior; moreover, an electric ventilator keeps constantly introducing cool air from the exterior. The negatives are about eleven inches square, and are projected upon a screen of 915 square feet.

Each of the apparatus is controlled by a bevel pinion that engages with a pinion which is secured to the extremity of a vertical rod that passes through the shelf, and the lower extremity of which is provided with a channeled pulley. The ten pulleys are connected by an endless belt which receives its motion from a transmission placed in the basement and actuated by an electric motor. The velocity is, therefore, the same in all the apparatus. In order to do away with the necessity of changing the bands, an operation which would consume too much time, they are fastened end to end. There is thus obtained for each apparatus a band nearly 1,300 feet in length, inclusive of the black portions designed to separate each view. The band is wound upon a spool placed above the apparatus, and in measure as it passes behind the objective is received by another spool placed beneath. Here there was a great difficulty to be overcome, namely, that of obtaining a feeble and uniform traction upon the band, despite the constantly varying differences in the diameter of the spool. The trouble was overcome through the use of gearings and counterpoises, which act upon the two spools nearly after the manner of a turn-spit. After the passage of the entire film around the lower spool, advantage is taken of the interval between two representations to cause it to wind around the upper spool.

The problem of cinematographic projection has long haunted the brain of the inventors, and M. Grimoin-Sanson has been the first to solve it. If the results do not respond to hopes, it will be necessary especially to impute the fault to the tentatives inseparable from a first experiment.

In an enterprise of this kind, in which everything is new, we meet at every instant with unforeseen difficulties that time alone permits of surmounting.—For the above particulars and the illustrations, we are indebted to La Nature.

ON THE MOUNTING OF LANTERN SLIDES.*

OUR English cousins, who generally do things the hardest possible way, and generally have a good reason for doing it, have adopted the square 3¼ by 3¼ inch size for slides. The saving in weight of one hundred of these, as compared with one hundred American standard slides, is considerable, but after admitting this there is little to be said in their favor. As some of us have learned to our sorrow, there is but one right way to place a slide in the lantern so that the image may appear in its proper position on the screen. Now, with an English slide, which is square, it is possible to place it upside down, or on either of its sides, or right side up, and then turning it about, so that the left side of the picture appears on the right to repeat the four operations again, making eight possible ways of inserting the slide in the carrier, and but one right way. With the 3¼ by 4 inch or American slide, there are but four possible ways of inserting in the carrier, three of which are wrong and one right. There are thus seven possible wrong ways of placing an English slide in the carrier; there are but three in the American slide. It will be seen from this example how easy it is to run American slides through the lantern with a fair probability of getting them right as compared with English slides; but, in addition to this, the greater margin on the lantern slides, and more ample labels, makes it easier to make them in some certain way which may be easily distinguished by the operator in a dimly lighted room.

At first sight, it would seem a very simple matter to label a slide for easy identification and insertion in the lantern; but, from the number of different schemes which make their appearance in going over a miscellaneous lot of pictures, one is almost led to believe it is a most difficult problem.

The American Lantern Slide Interchange, soon after its inauguration, formulated a set of rules governing the mounting and labelling of slides submitted by its members, which I regret to say have been violated time and time again by some, while by others they have been observed principally by their non-observance.

Supposing that the slides for an exhibition have been arranged in order, about the only mishap which may occur is that the pictures appear on the screen upside down. The little thumb label, which some considerate persons place on the lower left-hand corner of each slide when it is viewed in its proper position, is of great value, and no one who has not had experience with these little white circles has any idea of the comfort and relief they are when they are placed on the right—that is, the lower left-hand—corner of the slide. But, if blindly followed, the thumb label is pretty sure to lead into trouble, because there are several schemes of applying it to the slide. The English are the most fertile in these, and, not being satisfied with one label, often insist on placing two, three, or even four on the cover glass. These are worse than nothing at all, as they are most misleading.

One of the neatest methods of applying the thumb label is on the mat placed between the slide and cover glass. The side of the mat which comes next to the condenser is left white, and on it may be written the title of the slide, the author's name, or any other data, while a black dot on the paper cover shows very distinctly, even in a dark room, the proper position of the slide in the lantern. This method, if universally adopted, would furnish a satisfactory solution of the problem of slide-marking.

Respecting the title label, which is usually pasted on one end, but little need be said; so long as it is firmly attached to the slide and legibly written upon, its duty is fulfilled. Some people paste this label on the front when the slide is viewed in its proper position, and some on the back; doubtless many paste it on the first side they pick up. This label is mostly pasted on the left-hand end of the back, opposite where you would endorse your name if the slide were a check. The English slides, which usually are made on much thicker glass than is common in this country, often have the names written in very small letters on the edge. The advantage of this is that the title may be read while the slide rests on end in the box, but the space is so small that at best but a few words can be written. The title label on quite a number of slides is placed on the front, opposite the thumb label. This is rational, as the name can then be read without turning the slide over, and the position corresponds with the title when written on the white mat.

* Paper read before the Photographic Society of Philadelphia, by W. S. Vaux, Jr.

A NEW CALCOGRAPH.

WHEN it is desired to reproduce a drawing easily, it suffices to place it upon a table, lay a sheet of white paper alongside of it, and fix a pane of glass vertically

NEW CALCOGRAPH.

in the center. Upon leaning toward the side on which the drawing to be reproduced is situated, and looking through the glass, we shall perceive upon the paper the contours of the drawing, which may be easily followed with a lead pencil.

Although this arrangement may certainly prove useful in numerous cases, it presents the drawback of giving reproductions that are symmetrical, and that consequently are not conformable to the model, but are reversed.

M. Prud'homme, of Paris, has devised a new and very simple arrangement that permits of obviating the inconvenience just mentioned. The accompanying figure, from La Nature, gives a general view of the apparatus ready for use.

In front of the draughtsman is placed vertically a sheet of cardboard, to which is fixed the drawing to be reproduced. In front of this is placed a mirror, which is held by a small standard, and is so inclined as to form an angle of 45° with the sheet of cardboard. Upon the right hand side is fixed a pane of glass in a vertical position.

The draughtsman has merely to place himself in the position shown in the engraving, and look at the paper through the glass, when he will see an exact image of the model.

It is easy to see that the mirror gives a reversed image of the model, and that such image is reversed in its turn through the transparent glass, and thus faithfully reproduces the original drawing.

THE COLORING OF SOAP AND CANDLES.

By GEORGE H. HURST, F.C.S.

THE problem of giving soap and candles a beautiful color, at a low extra cost, has become quite an important one at the present day, consumers in general giving preference to the colored goods. The solution of this task, which is now a familiar one to the manufacture of soap, and especially of toilet soap, where the requirements are limited to a beautiful color that will remain unchanged on exposure and not cause stains in washing. As regards colored candles, there is the additional demand that the color must not interfere with the burning of the candle in any degree. This feature raises a material difficulty in the coloring of stearine and wax candles.

Regarding soap, the first point to be observed is to select the proper shade of the flower corresponding with the perfume used, for instance, and almond soap is left white; rose soap is colored pink or red; mignonette, green, etc.

The colors from which the soapmaker may select are exceedingly numerous; not only are most of the coal tar colors adapted for his purpose, but also a very great number of mineral colors. Until a comparatively recent time the latter were almost exclusively employed, but the great advance in the tar color industry in later years has brought about a considerable change in this respect. A very prominent advantage of the mineral colors is their stability; they are not changed or in any way affected by exposure to light. This advantage, however, is offset in many cases by the more difficult method of application, the difficulty of getting uniform shades. The coal-tar colors give brilliant shades and tints, are easy to use, and produce uniform tints.

The specific gravity of mineral colors being rather high, in most cases they will naturally tend to settle toward the bottom of soap, and their use necessitates crutching of the soap until it is too thick to allow the color to settle. For mottled soap, however, vermilion, red oxide and ultramarine are still largely employed.

For transparent soap, of course, mineral colors are not applicable, as they would detract from their transparency; for milled toilet soap, on the other hand, they are very well adapted, as also for cold-made soaps, which require crutching anyway until a sufficient consistency is obtained to keep the coloring material suspended.

A notable disadvantage in the use of aniline colors, besides their sensitiveness to the action of light, is the fact that many of them are affected and partly destroyed by the action of akali. A few of them are proof against a small excess of lye, and these may be used with a good effect. Certain firms have made a specialty of manufacturing colors answering the peculiar requirements of soap, being very easy of application, as they are simply dissolved in boiling water and the solution stirred into the soap. To some colors a little weak lye is added; others are mixed with a little oil before they are added to the soap.

For a soluble red color there were formerly used alkanet and cochineal; at present they have been displaced to a great extent, on account of their high cost, by magenta, which is very cheap and of remarkable beauty. A very small amount of it suffices for an intense color, nor is a large proportion desirable, as the soap would then stain. Very delicate tints are also produced by the eosine colors, of which those named rose bengal, phloxine, rhodamine and eosine are most commonly used. These colors, when dissolved, have a brilliant fluorescence which heightens their beautiful effect.

There are also a number of the azo dyes, which are suitable for soaps, and these, as well as the eosine colors, are used principally for transparent soaps. For opaque soaps both aniline and mineral reds are used, among the latter being vermilion, chromo red, and iron oxide. Chromo red is a basic chromate of lead, which is now much used in place of vermilion, but, as it becomes black on exposure to an atmosphere containing even traces only of sulphuretted hydrogen, it is not essentially adapted for soap. Vermilion gives a bright color, but its price is high. Iron oxide, known in the trade as colcothar, rouge, etc., is only used for cheap soaps.

For yellow there are also a considerable number of colors. Among the natural colors here are saffron, gamboge, turmeric and caramel (sugar color); the first named of these is now hardly used, owing to its high cost. Of the yellow aniline colors special mention must be made of picric acid (trinitrophenol), martius yellow, naphthol yellow, acid yellow and auramine. If an orange tint is wanted, a trace of magenta or safranine may be added to the yellow colors named. The use of some unbleached palm oil with the stock answers a similar purpose, but the color fades on exposure. A mineral yellow is chrome yellow (chromate of lead), which has the same advantages and disadvantages as chrome red.

Of the blue aniline colors, there may be used alkali blue, patent blue, and indigo extract. Alkali or aniline blue is soluble only in alkaline liquids; white patent blue is soluble in water and in alcohol. Both blues can be had in different brands, producing from green blues to violet blues. Indigo extract, which should be classed among the natural colors rather than among the tar colors, is added to the soap in aqueous solution.

Of ultramarine there are two modifications, the sulphate and the soda. Both of these are proof against the action of alkali, but are decomposed by acids or salts having an acid reaction. The former is much paler than the latter; the soda ultramarine is best adapted for coloring soda soaps blue.

The ultramarine is added to the soap in the form of a fine powder.

Smalt is unsuitable, although it gives soap a color of wonderful beauty because a considerable quantity of it is required to produce a deep color, and, furthermore, it makes the soap rough, owing to the gritty nature which smalt has even when in the finest powder. By mixing the blue and yellow colors named, a great variety of greens are obtained. It would be too far to go into details about the proportions to be observed, but we will point out that both component colors must be entirely free from any reddish tint, for the latter would cause the mixture to form that dirty green color which is only occasionally produced intentionally for "herb soaps."

Of the colors producing green directly the two tar colors, Victoria and brilliant green, are to be noted; these give a bright color, but fade rapidly; thereby the soap acquires an unsightly appearance. For opaque soap of the better grades, green ultramarine or chrome green are used.

Gray and black are produced by lamp black. For brown, there is Bismarck brown among the aniline colors and umber among the earthy pigments.

For coloring candles the proceeding is less simple, as the first condition—quiet burning—excludes the mineral colors from the start. Candles are colored either throughout or they sometimes consist of a white body

that is covered with a colored layer of paraffin wax. According to the material from which candles are made (stearine, paraffin or ozokerite), the process of coloring varies.

Stearine, owing to its acid character, dissolves the coal-tar colors much more readily than do the perfectly neutral paraffin and ozokerite waxes. For coloring stearine, the necessary quantity of the color is added to the melted mass and well stirred in; if the solution effected happens to be incomplete, a small addition of alcohol will prove an effective remedy. It is also an advantage to dissolve the colors previously in alcohol and add the concentrated solution to the melted stearine. The alcohol soon evaporates, and has no injurious effect on the quality of the stearine.

For a number of years there have been on the market so-called "fat colors," formed by making concentrated solutions of the color, and also special preparations of the colors in stearine. They are more easily applied, and are, therefore, preferred to the powdered aniline colors, which are apt to cause trouble by being accidentally distributed in soluble particles, where they are not wanted. Since paraffin and ozokerite dissolve comparatively little, they will not become colored, and so must be colored indirectly. One way is to dissolve the color in oleic acid or in stearine acid and adding the solution to the wax to be colored. Turpentine may be employed for the same purpose. Concerning the colors suitable for candles, there are the eosine colors previously mentioned, and also chroline yellow, auramine, taniline blue, tartrazine, brilliant green, etc. The latter, however, bleaches so rapidly that it can hardly be recommended. An interesting phenomenon is the change some colors undergo in a warm temperature; for instance, some blues turn red at a moderate degree of heat (120° F.) and return to blue only when completely cooled off; this will be noticed while the candle mixture is being melted previous to moulding into candles.—Oils, Colours, and Drysalteries.

[Continued from SUPPLEMENT, No. 1286, page 20610.]

AMERICAN ENGINEERING COMPETITION.*

VII.—MANUFACTURE OF STEEL—II.

OPEN-HEARTH steel furnaces are changed from the platform as already described, unless direct metal is used. When the metal is ready it is tapped from the opposite side of the furnace and run into a ladle. From the latter it is poured into moulds to be cast into ingots. The ingot moulds are massive cast-iron boxes without top or bottom, and of rectangular section; flat ingots are often cast, especially for heavier work. The ingots vary in size according to the purpose for which they are needed. In America a typical ingot for rolling into plates would be about 12 in. by 36 in. by 48 in. and would weigh nearly two and a half tons. Ingots up to ten tons weight are not altogether uncommon, and for armor plate work far larger masses are cast together in one mould.

The steel, as stated, is poured from the steel-making furnace into a ladle, and from the ladle it is run into the ingot moulds. The practice in England is to place these moulds in a pit, where they remain until the ingot is solid enough to stand on end. The moulds are then stripped off by a crane, the ingots being left standing on the floor of the pit. The still red-hot ingots are loaded onto railway trucks by a crane and taken away to undergo further operations in the steel mill. The American practice differs from this. In the first place, the casting pit is not used, except for very large ingots such as those needed for armor-plate work. The ladle, with the molten steel fresh from the furnace, is taken by an overhead traveling crane and brought into position over the ingot mould, when the metal is run in the usual way. The ingot moulds, however, instead of standing on the ground, are placed on a specially made bogie or small railway truck, the platform of which itself forms a bottom to the open ended moulds. In the English practice the bottom of the pit forms the bottom of the mould. In America, as soon as the moulds have been filled with the molten steel, the bogies on which they rest are drawn away by a locomotive, and when the steel is sufficiently set the moulds are stripped off. In place of this being done, as in England, by a simple crane lifting off the moulds, the weight of the ingot being relied upon to keep it from rising at the same time, a special stripping machine is brought into play. This consists of two suspended hydraulic cylinders, under which the trucks, with the full ingot mould on them, are run. Hooks, attached by links to one of these cylinders, engage with lugs in the mould, while the other cylinder pushes down a foot which presses on the ingot itself and prevents the latter from rising when the mould is lifted off. The rapidity and certainty with which this machine works are very pleasing.

American steel-makers prefer their own system of dealing with ingots to that which we follow, and one is bound to respect their opinion, as they have gone to much expense in substituting the new system for the old. The overhead traveling electric crane they use is an expensive machine, and the hydraulic stripper is also an additional first-charge; but, to judge by the desert appearance of an American steel-melting house in front of the furnaces, these appliances must save a good deal of labor. Some British steel-makers, however, attach a good deal of importance to ingot moulds not being taken out of the melting-house.

It will readily be understood that it is desirable the ingot should remain red hot for the subsequent operations of rolling into plates, rails, etc. The metal as it comes from the furnace, being quite fluid, is naturally more than hot enough, and it might seem a simple matter just to let it cool to the right temperature and then roll it. A little reflection, however, will reveal a difficulty which makes this impossible. The ingot is cooled by radiation, and, therefore, the outside of this mass of steel, weighing perhaps as much as ten tons, will be of a moderate heat, while the core would still be quite fluid. Very terrible accidents have happened through moulds being prematurely stripped. The solid walls may not have become quite strong enough to stand the pressure of the fluid metal, and this has burst out, sending a flood of liquid steel across the ingot pit, overwhelming everything in its course.

It will easily be seen that, this being a possibility when an ingot has only to stand up under its own weight, it would be hopeless to expect to subject it to the enormous pressure of passing through the rolls in order to flatten it to a plate or extend it into a rail. The colder outer skin would at once be ruptured and the fluid inner part would spurt across the mill, carrying destruction before it.

In these circumstances it became necessary to let the ingot cool sufficiently and then place it in a special furnace, where it remained until hot enough for rolling. In this case, the heat being taken from outside, and the reheating furnace never having the high temperature of the melting furnace in which the steel was made, there was no fear of the liquid core spurting out when rolled. An ingenious Scandinavian steel-maker, the late Mr. Giers, who had early settled in England, devised a scheme for utilizing the primary heat of the ingot. He constructed pits in the ground, known as soaking pits. These were lined with refractory material and had fire-brick covers. It was thought that the heat would be retained in the pit, as it radiated from the ingot, which would thus be "soaked" to a uniform temperature throughout. To a large extent this end was reached, but it has been found desirable to supplement the original heat from the ingot by a certain amount of gas burnt in the soaking pit, although big ingots may be soaked effectively with very little gas expended.

In European steel works the gas used in the various furnaces is made in special vessels known as producers, but in some parts of America, especially in the Pittsburg district, they have the advantage of natural gas. This is a very much richer fuel than the producer gas, and for this reason offers advantages to the steel-maker apart from its cheapness.

It is used exclusively for many purposes in the Pittsburg steel works, being employed in the open-hearth regenerative furnaces, already described, in which the steel is made. In any case the ingot has to be placed in the furnace through a hole in the flooring. In America time and labor are saved by fitting hydraulic cylinders to the covers of the charging holes. This is a very convenient arrangement, far more handy than the hand lever common in England, or the practice of bringing the hydraulic crane into play. The American crane by which the ingot is placed in the pit is also devised to save labor. It has a rigid guided plunger, worked by a rack and pinion, so that there is no need to direct the ingot into the pit in the manner necessary if it be swinging free, as with an ordinary crane. There is also a pneumatic device for closing the tongs to grip the ingot. For this purpose air is compressed by a small electric motor on the operator's platform.

The effect of attention to these details is shown in the very small number of men there are alike on the charging platform of the furnaces, in the melting house generally, and round the pits. Everything, indeed, is done by machinery, not only the lifting, but the guiding and picking up of the ingots. There are just a few operators to turn handles or press levers. It is these things that enable the American manufacturer to pay his men higher daily wages than are usual in older countries, although the labor, when reckoned by product, is the lowest in the world; therefore, both masters and men are better off. It will, of course, be understood that in British iron and steel works there are labor-saving appliances, some of which may have been copied from other countries, while others have originated at home. Doubtless many, one might say very many, of the inventions seen in the United States were first produced in England. The American manufacturers, however, have done the whole thing more completely—have worked in thousands while we have hesitated with tens—and they have reaped the reward of their fearlessness. If they have at times suffered from the defect of rashness in pushing enterprise too far, the net result remains that American steel plants can be worked with less labor than ours, and material can be produced at a cheaper rate than in this country.

The ingot after being taken from the soaking pit commences the second stage of its career, which consists entirely of mechanical operations. In fact, it ceases to be an ingot, the rolling mill to which it passes converting it ultimately into a plate, rail, bar, or other finished product of the steel works, or possibly it may be sold in the shape of a slab, billet, or bloom. The machinery by which these operations are effected is of a most powerful description and may be ranked among the greatest triumphs of mechanical engineering enterprise, whether in Great Britain or the United States. The procedure in the two countries differs in many details, and not a few essentials. The chief of the latter is the use by the United States steel-makers of three-high mills, while in England two-high mills are usual for anything like heavy work. To Mr. Fritz, of the Cambria Iron Works, the general use of three-high mills for heavy work is due; and the manner in which he insisted on the adoption of this system in opposition to the opinion of the directors of the company is typical of the practical and self-reliant class to which he belongs. The ordinary British rolling mill has two rolls, the axes of which are in the same vertical plane. The work is passed between the rolls backward and forward, the direction of rotation of the rolls being reversed with each pass, the engine having reversing gear similar in principle to that of a marine engine. Three-high rolling mills have three rolls placed above one another, and the middle roll naturally revolves in an opposite direction to that of the top and bottom ones. In this way it will be seen that if the object to be rolled is passed between the bottom and middle roll it can be sent back between the middle and top roll, no reversing of the rolls being needed. To work in this way it is necessary that the heavy steel object that is being rolled should be raised in order to be entered between the top and middle rolls for the return pass. It is the perfection to which the American engineers have brought the mechanism of the rolling mill that enables this to be done with facility and ensures the success of the system. It should further be stated that the profitable working of the three-high mill largely depends on the typical American practice of standardizing the product. The two-high mill is readily adjustable in regard to the thickness of the work, as the top roll can be easily raised and lowered, thus altering the space between the rolls at will. It may be said in favor of the English practice that one or two important mills lately installed in America have been two-high; still, the highest product has been obtained from three-high non-adjustable rolling mills. I believe the "record" for rails is held by the three-high mill of the Edgar Thomson works of the Carnegie Steel Company. When I was last at these works—i. e., in November, 1899—the accounts showed that during the previous month 70,000 tons of Bessemer ingots had been produced by the furnaces, and 57,000 tons of rails had been rolled. The rate of the total annual product of rails up to that time was 650,000 tons, so October, 1899, was a trifle below the average.*

To turn again to the plate mills, one of the best equipped in America is that of the Illinois Steel Company at South Chicago, these works being part of the amalgamation known now as the Federal Steel Company, to which reference has already been made. I mention this plant, as it is described by Mr. S. T. Wellman, of Cleveland, Ohio, in a paper he read before the Institution of Civil Engineers. English engineers may, therefore, readily find details, together with other interesting matter, in the proceedings of that institution. There are two stands of three-high rolls, and ingots 24 inches thick can be taken by them. The ingot is placed on a "table," so called. It consists rather of a framework, in which are mounted live rollers with their axes in the same horizontal plane, and all parallel to the mill-rolls. When the ingot is placed on these rollers, they are caused to revolve by an engine, and the ingot is thus impelled forward and thrust between the rolls of the three-high train. Having been considerably flattened by passing through the mill, the red-hot ingot, which may weigh from seven to eight tons, is deposited on another table fitted with rollers. This table is now raised bodily the necessary height to present the ingot between the top and intermediate rolls, when another pass is made, and so on until the plate is rolled.

It will be noticed that the ingot is made directly into a plate at one heat, whereas the old process, still followed in England, is to roll the ingot into a slab on a cogging mill, then to reheat the slab and roll it into a plate. This absence of cogging affords another instance of American boldness in the effort to save labor. In early days steel ingots were worked under the steam hammer to reduce them to the required dimensions, and subject them to the "work" which was considered needful for producing trustworthy material. The cogging mill took the place of the steam hammer, in much the same way as the hydraulic press has superseded the latter for heavy forging. The result of the introduction of the cogging mill was a great saving in labor and a greater gain in expediting work. It is held by some that trustworthy results cannot be secured when plates are reduced from ingots direct, but tests that have been made hardly bear out this view. Naturally, the plate mill, working blooms that have been cogged from the ingot, will produce more plates than the mill which carries on both operations. Which system is the more advantageous in the long run appears to be a matter of opinion, in which British and American steel-makers take opposite sides. As all the rolling has to be done at one heat on the American system, the speed must almost necessarily be greater, and rolls are, therefore, run faster than with us, a fact which in itself accounts for larger production. At the Homestead Works there is a 38-inch blooming mill which is run by the engine by direct connection, without the intervention of gearing, a remarkable fact in itself. In this mill nothing at all is done by hand, except, of course, the controlling of the hydraulic turning gear; indeed, the whole process is so strictly mechanical in its nature that hardly any men are seen around the mill. The electric crane places the hot ingot on the approach table, which contains live rollers driven by an electric motor. The revolving of the rollers carries the ingot to the table of the mill, which has also driven rollers. These are actuated by a steam engine, as they have to be reversed. The ingot is then reduced from its original dimensions of 18 inches by 20 inches in section to 4 inches by 4 inches, and of course proportionately longer. It is then taken by a long train of live rollers to a pair of steam shears, where it is cut up into suitable lengths or blooms, the powerful blades of the machine shearing through the huge bar of steel with ease. The billets as they come from the shears pass, by themselves, to shoots and so into railway trucks for despatch to their purchasers. All these operations are carried out by machinery, human intervention being needed only for directing the mechanism. At Homestead, I was informed, plates 10 feet 6 inches wide, 70 feet long, and 1¼ inches to 2 inches in thickness can be rolled, and it is quite possible to roll a 100-ton ingot.

Among other labor-saving devices that may be mentioned is the hydraulic machinery for turning ingots in the heating furnaces. Again, the Wellman machine is largely used for charging and withdrawing blooms in reheating furnaces. These machines are placed on rails and run up and down in front of the furnaces, doing their work with an ease and expedition that are a great contrast to the exhausting and trying labor which is needed by men working in the old fashioned piel still in use. The Wellman machine takes the bloom and delivers it to the live rollers of the mill table, by which it is fed up to be rolled into a finished part. Another labor-saving device is secured by the use of a powerful electric magnet, in place of an ordinary hook, for lifting plates and other parts by the electric crane. The magnet is brought in contact with the plate, and the current is then applied. This causes the two poles to become magnetic according to the well-known law, and the plate bar, etc., is duly raised upon the crane's being set to work. It is said that as much as fifty tons have been lifted in this way. The saving in labor will be apparent, for it is often a difficult task to get the slings round the plate or to attach hooks. The system is not without its drawbacks. One of the chief is the probability of lifting two plates instead of one, when they are piled one above the other. There is also the possibility of the electric current being interrupted from some accidental cause,

* This series of articles on American Industries was written by an expert of The London Times, who made an extensive trip through this country in order to prepare the articles, the first of the series being published in the SUPPLEMENT of July 21.

* Since the above was written the following paragraph has appeared in Engineering: "The world's record for turning out steel rails was again broken at the plant of the Illinois Steel Company, when a day shift put out 1,442 tons in 12 hours. The night shift turned out 1,235 tons, making a total for 24 hours of 2,677 tons. During the 24 hours the rolls were shut down 1 hour and 57 minutes."

when, of course, the plate would be dropped. Again, when the current is shut off the plate may still be held for a second, owing to a cause somewhat obscure in its origin, but which takes the form of residual magnetism. A further defect is that a plate will be apt to slip if the poles are not normal to its surface. At the Illinois Steel Works, where this system is largely used, I saw a bent plate quite baffle the efforts of the crane to get hold of it. All these points being taken into consideration, however, there is no doubt that the magnetic system affords a very appreciable and very valuable saving in time and labor. Moreover, the chance of accident through the magnet letting go is less than that of men being injured through the buckling of plates, and hooks consequently flying off.

There are many other details of rail and plate rolling that could be described did space permit. There are the methods of handling the plates at the shears, by which the labor of a considerable number of men is dispensed with. A simple but most effective device here is known as the "goose-neck." It may be likened to a very strong table-leg stuck in the ground with the castor upward. At South Chicago there is a perfect forest of these, and it is quite possible for a man to walk about among them and push a heavy plate in any direction with comparative ease. The rail mill at Carnegie's Edgar-Thomson Works, which has such a remarkable productive capacity, would be well worth detailed description did space permit. It is a really wonderful example of rapid working and automatic operating from first to last.

Nothing, also, has been said about the rolling of steel beams, channels, and other structural material. The American steel-makers have paid special attention to this branch of industry, the number of different sections they produce being remarkable. One firm in Pittsburg, Jones & Laughlin, roll forms that appear almost bewildering in their variety, but nevertheless must much simplify the labors of the engineer and architect in designing steel structures. Notwithstanding the enormous scale on which their neighbors, the Carnegie Company, operate, the works of this firm are truly remarkable, and many details of their splendid plant are well worthy of attention. To give an idea of the magnitude of this structural steel industry—and it is rolled sections that constitute the bulk of this firm's product—it may be stated that in their steel works alone they employ about 5,000 men. They have four blast furnaces, each making 600 tons of iron a day, and also one producing 300 tons a day. Their Bessemer plant will turn out 2,500 tons of steel a day, and the mills will roll 2,000 tons of finished shapes per day. A very interesting feature here is the cold rolling of shafting up to 5 inches in diameter and up to 50 feet in length. This can be produced to such a degree of accuracy that it will not vary one-thousandth of an inch above or below the specified size. What this means in the way of finished machiney for its production engineers will appreciate. The shafting is straightened in hydraulic presses, and is even better than the far more costly turned shafting, as the rolling increases the strength. A good deal of it is sent to England. The company get their ore from their own deposits on Lake Superior; they have their own coke ovens, about twenty-five miles away, up in the mountains; and their own coal fields, from which they bring coal by river fifty miles to Pittsburg, to be made into coke near the blast furnaces. The magnitude of the business done by this firm has doubled within the last five years, and has increased fourfold since 1882. They roll a standard section solid steel I beam 20 inches deep and 7¼ inches across the flanges. A great many of the three-flanged steel posts for wire fences that we see in England are rolled at these works.

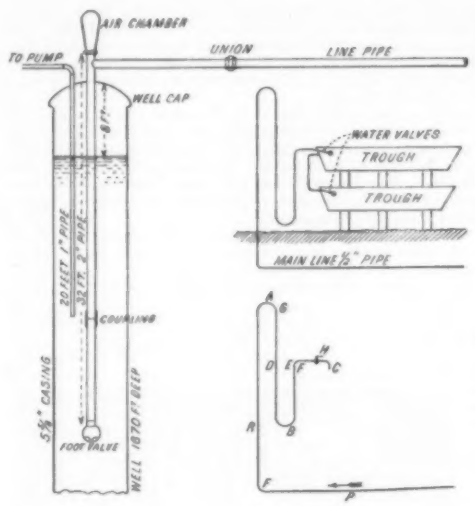
MY EXPERIENCE WITH A SIPHON PIPE LINE.

To the Editor of the SCIENTIFIC AMERICAN SUPPLEMENT:

THE device I wish to describe is very simple but also very convenient when you have a siphon with two or more hydrants, or where there is one, four, five or any number of valves or faucets connected with a siphon line. If this device is used you are enabled to use fittings which are not in themselves air-tight, but which are made perfectly so by means of this device, and which remain airtight without looking after much longer than the ordinary fittings to be had at any of the stores.

On my father's farm is an artesian well, about 1,670 feet deep. This ceased to flow, the water rising only to within 8 feet of the top. The well is on the highest point of the farm, having an elevation above sea level of about 600 feet. The dairy, barns, troughs, etc., were found on investigation to be 50 feet lower. The question then arose as to whether we could use the water as we had formerly. The first thing to do was to make the line airtight. This was done by taking out cut-offs, defective pipe, etc., and connecting the pipe together with red lead in the threads. It was also necessary to insert a pipe in the well with a foot valve at the lower end so that the whole line could be filled with water. Another pipe 20 feet long was put in the well and a pump with hose connections attached to it to fill up the line. The joining of the line pipe in the well is a T which has a plug in the top. When the plug is unscrewed the line is filled through this opening; the water going into the line forces the air out. When a solid body of water is obtained the plug is put back, with red lead in the threads, and the line is ready for use.

The questions which arose were the following: 1. How possible to use a double trough (that is two troughs, one upper and one lower) so as to furnish water to both from the same pipe by means of a siphon. 2. How possible to plan the siphon so that two double



troughs and three hydrants could be used at the same time.

The first question (without going into details) was settled in this way: The pipe was connected with the water valve in the upper trough and the upper trough filled from this. A hole was bored in the end of the upper trough, near the top, and a pipe inserted and connected with an ordinary water valve in the lower trough. When the upper trough fills, the hydrostatic pressure causes the water to flow from it into the lower trough, until the lower trough becomes full, when the water will be shut off by the valve. Afterward, when the upper trough fills, the water is shut off from it by the valve in this trough.

The second question, which also includes the first one, was much more difficult. Not only must the hydrants and water-valves remain closed during certain intervals, but all or most of them must be used at the same time; or one or two be used while the others remain closed. To accomplish this it was necessary to use not only the closed pipe connections, but also to impose some obstacle to the pressure of the air. This was done by using the lever cut-off and by utilizing the principle of the U tube, as shown in the figure. The same device is used in connection with the upper valve of the water trough. It consists of an upright pipe, *R*, to which is attached the rest of the apparatus. See figure. The distance, *AB*, is greater than that of *BC*, so that when the water reaches *A* and fills *AB*, it is forced out at *C* by its own weight and the pressure behind, unless the faucet be closed. The water standing in the U tube, *DBE*, although it does not interfere with the water flowing from the hydrant, offers a resistance to the air, which tends to force itself in if the water be not flowing at *C*, and the faucet be open. In the figure, *F* is an elbow, *G* is a return bend, and *H* is a lever cut-off.

The line I refer to is about three-fourths of a mile long, and starting with a 2-inch pipe at the well is reduced to 1 inch, and then to ¾ inch at the troughs and hydrants at the barns. There are about 1,320 feet of 2-inch, 1,980 feet of 1-inch, and 900 feet of ¾-inch pipe on the line. There are two troughs and three hydrants on the line.

The siphon has been in use for about two years and has proved a very satisfactory arrangement. The well is located on a hill about the center of the farm. The water from the artesian well contains air in mechanical combination. A certain part of the air is liberated when the water flows down the pipe line. The liberated air collects at the apex. When it reaches a certain amount it cuts the stream of water and stops the flow. The length of time during which the siphon will operate before it must be again refilled depends on the amount of water used and the amount of air left in the pipe when the water is started to flowing. In my case the interval is from one to five weeks. It takes from two to three hours to fill up the line and start it to flowing when it is first started, but the time is much less when the line is filled before it becomes entirely empty. I would like to hear from any one who has had experience with a siphon.

I believe from my experience with both that in most instances the siphon is preferable to a windmill. The main thing is to keep the line airtight. It costs less to start on, it seldom gets out of order, it costs little to repair, and can be left in the care of an inexperienced farm laborer.

JOHN K. PRATHER, B. S.
University of Texas.

EARLY AMERICAN LOCOMOTIVES.

To the Editor of the SCIENTIFIC AMERICAN SUPPLEMENT:

WILL the author of the interesting articles in SCIENTIFIC AMERICAN SUPPLEMENTS, Nos. 1275, 1276 and 1277, pardon one whose earlier life was intimately associated with a few of the engines described, if he makes a few corrections of points which the drawings used led the author of the articles referred to, to suppose correct?

Cut No. 6, page 20433, is made from a photograph of Pennsylvania R. R. engine No. 42; taken only a short time before engine was cut up in 1869. It shows the engine as rebuilt in part, at Altoona, in 1864, by J. P. Laird, M.M. At this time it received the Laird stack and guides, the shifting links, the casings on dome, cylinders and steam chests; also iron-lifting Sellers injectors, which were, about 1868, replaced on the right hand side by the pump shown.

Originally this engine was one of six built by M. W. Baldwin in the latter part of 1852 and early part of 1853.

It was placed on the road in December, 1852, and was named Cumberland. This name was removed and the number 42 substituted in 1857, when the company first adopted numbers.

When first built a single pair of 30-inch wheels were used instead of the four-wheel truck shown, and this pair of wheels was placed 60 inches (center to center) forward of drivers and was carried by boxes moving in rigid pedestals attached to the frames.

These leading wheels were replaced, in 1854, by the four-wheel trucks, owing to difficulty experienced in curving.

The firebox was of the H. C. Campbell type, the wagon top with a vertical drop in front, and no jacket upon it or upon the dome. This vertical front sheet was replaced about 1856 by the usual sloping type. No bell was used until 1862, and a column bearing the whistle and a safety-valve was originally upon the boiler about midway between the sand-box and forward tube-sheet. This was removed in 1864.

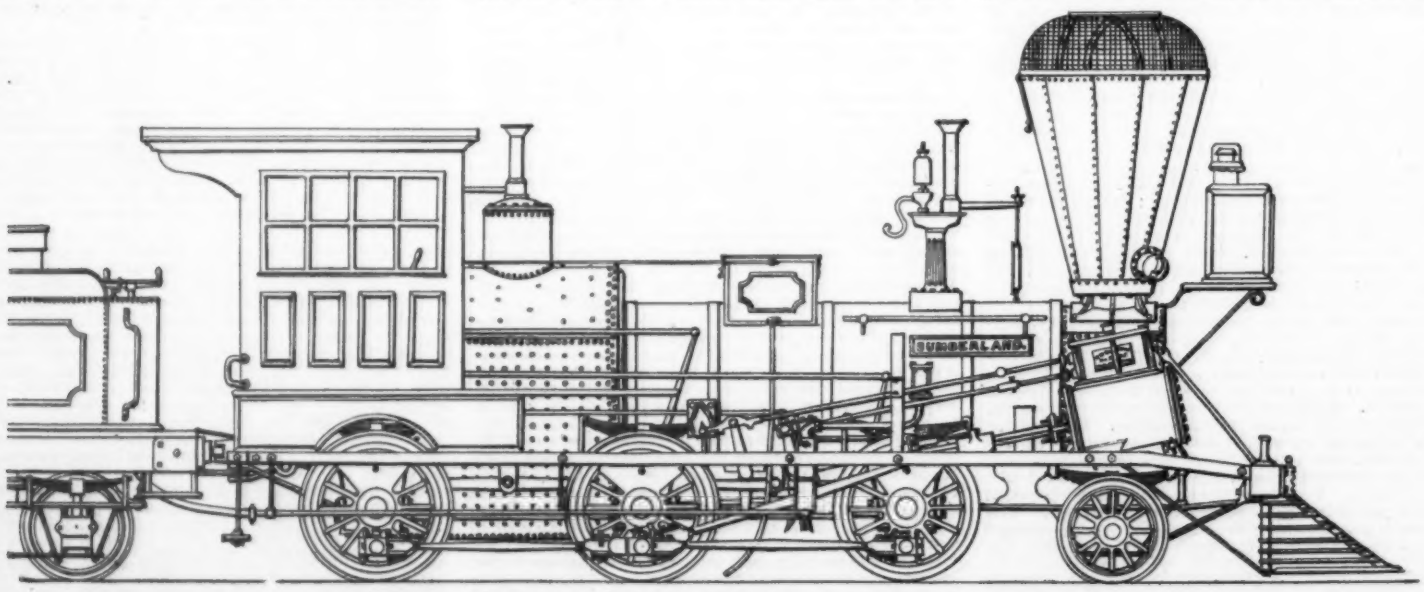
The guides were of a type much used by Mr. Baldwin, two diamond bars, one each side of the piston horizontally.

Two Baldwin pumps were used; the parts of the barrels being held together by yokes, with screw at bottom.

The valve motion was of V-hook type, with an independent half-stroke cut-off. The steam-chest was divided in the center into an upper and a lower story.

The main valve occupied the lower part, the cut-off valve the upper. The steam entered this part first and passed to the lower through a part which was opened full when the cut-off valve was disconnected.

The frames shown in the drawing are the original, the only change being that necessitated at the forward end, where the four-wheel truck replaced the single pair of rigid leading wheels, and the changing of the



CUMBERLAND—PENNSYLVANIA RAILROAD, No. 42—BUILT IN 1852.

equalizing beams from underneath the frame to a point above, as shown.

The original cab was of same size as that shown and only differed in having four panels in place of one and being continued below the running-board in the form of an arched wheel cover.

The engine also had auxiliary frames on the outside. They were 1 by 4 inches and extended from front bumper to rear bumper. These were removed in 1864.

The usual conical stack of that period, with a hemispherical netting over the top, was used until replaced in 1864 by the Laird stack shown.

The engine was a coal-burner from the first and the cylinders were 18 by 22 inches; not 16 by 24 inches, as you have stated.

The weight was 59,600 pounds, of which 42,800 pounds were on the drivers.

Six others (one of which was at once sold to the State, but returned into possession of the Pennsylvania R. R. by the purchase of the Public Works in 1857) of the same general type, but with slightly larger boilers, and using the four-wheel truck, were also built at the same period by Mr. Baldwin. They also had 18 by 22 inch cylinders and 44 inch drivers, but weighed 64,500 pounds, 46,100 pounds being on the drivers.

The print accompanying shows original form of 42, and the dotted lines show difference between it and the larger type referred to. The construction number of 42 was 505.

As to engine shown in No. 7, the Pennsylvania Railroad Company's "Tiger," No. 134, the cut shows it correctly as it appeared when built and placed in service, January, 1857.

In 1868 it was changed to a coal-burner, received a Laird stack like that shown on 42, 279 and 421. The outside frames were removed at this time, and also the scroll-work of polished iron uniting the driving wheel covers. Otherwise the engine remained unchanged until worn out.

No. 8, showing 279, shows another Pennsylvania R. R. passenger engine built by R. Norris and Son, in 1863.

This picture is from a photograph taken in 1868 after some changes had been made at Altoona shops.

Originally, Norris' simple 4 bar guide with pin midway between top and bottom bars was used, instead of the Laird guide shown. The dome casing was of same design as that shown on "Tiger"; the bell-frame was an ornamental affair in shape, like that joining wheel-covers on Tiger, but of course with the widest part below. The cab was square, with a flat roof, and no pumps were used, but a non-lifting Sellers injector was placed diagonally on each side between the drivers.

This engine always was a coal burner. The Laird stack was never placed on any Pennsylvania R. R. wood-burner.

The cylinders of 279 were 17 by 24 inches, and the drivers 66 inches in diameter.

No. 9 is a Pennsylvania R. R., Class A, bituminous; now Class D 1; and differs only in a slight increase in dimensions from twenty built for the company between 1863 and 1867, by M. W. Baldwin and Company.

The cylinders of all were 17 by 24 inches and the drivers 66 inches.

No. 10 is correct; a Class C, bituminous (now D 3), built at Altoona shops, in 1875.

Cut No. 13 is correct; showing a Pennsylvania R. R. engine, of which the first few were marked Class P, but as the engines differed in so many respects from the other P's, the letter of a vacant classification, L, was assigned them and they retained it until the readjustment of classifications; since which they are marked D 16 and D 16 a.

Referring back to No. 4, the Pennsylvania Railroad Company had three "Crampton" engines built in 1849–50, by Baldwin, the Mifflin, Blair, and Indiana. In these three, the frames were entirely on the outside; an arrangement of levers enabled weights borne by the 46-inch carrying-wheels to be thrown on or off the drivers at pleasure. The driving axle was of the Baldwin half-crank type, and the valve motion was D-hooks, with independent half-stroke cut-off. A hay-stack dome surmounted a horse-shoe fire-box, and a smaller dome was placed on the forward end of the boiler. From this dome the steam was carried by outside branch-pipes to the cylinders, which stood horizontally directly in front of the carrying wheels, as on the "Lightning."

Baldwin's conical stack, with rounded netting cover of wire gauze, was used; also cabs and cow-catchers.

Their weight was 15,000 pounds on the four-wheel truck, 14,000 pounds on the carriers, and 18,000 pounds on the drivers; or a total of 47,000 pounds. The cylinders were 14 by 20 in.; drivers 72 in.; carriers 46 in.; and truck-wheels 36 in. Boiler 39 inches in diameter.

One of these engines remained in service, with but slight change from original design, until 1863.

Their construction numbers were 356, 371 and 372.

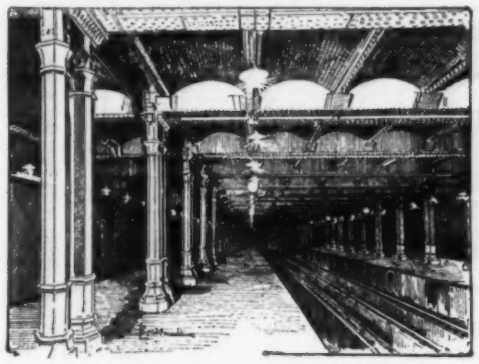
C. H. CARUTHERS.

Lansdowne, Pa.

THE OPENING OF THE METROPOLITAN RAILWAY.

THE first section of the Metropolitan Railway of Paris has finally been opened. By reason of the general satisfaction with which this news is received, we shall have no complaint to make about the manifold causes that have conspired, up to the present, to deprive Parisians of a method of conveyance that has long been enjoyed by the inhabitants of New York, Chicago, London, Vienna and Berlin. We shall simply say that we have had the patience to wait for many years, since the first project of a Metropolitan Railway studied at Paris was that of MM. Brame and Flachat, dating back to 1855.

How many turns of fortune since that remote epoch! The question came very nearly being settled ten years ago, when, upon the vigorous initiative of M. Alphand, an inquiry was instituted as to the project planned by the Campagnie du Nord and the Société Eiffel. This project, which was very fully elaborated, comprised, in the first place, the prolongation of the lines of the North, in Paris, toward the Halles and the Opera, then the construction of an internal belt line running through the boulevards from La Madeleine to the Bastille, with a return through Rues Saint-Antoine and de Rivoli, and a connection with all the railway stations. For its execution, there had been established a plan of work in which the Beach shield was to be employed, and in which various other measures were to be taken of a nature to prevent traffic from being interfered with. Divergences of views between the State and the city caused a miscarriage of the project, as had happened with all those that had preceded it and has happened with all those that have succeeded it; and it required working less than the perspective of the imperious needs created by the Exposition of 1900 to put an end to the conflict. We know that new administrative obstructions prevented Paris from having its Metropolitan at the date of the opening of the Exposition.

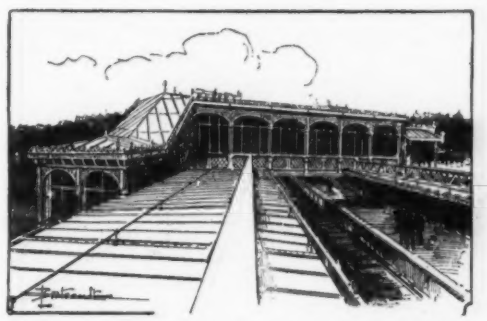


INTERIOR OF LYON STATION.

HOTEL DE VILLE STATION.

The line that is now inaugurated is the first section of the municipal project of which we have already described all the work. It extends from Vincennes to Porte Maillot and forms a great transverse line, 6·5 miles in length, running east and west. Two branches, starting from Place de l'Etoile and running, one of them, toward Porte Dauphine and the other toward the Trocadéro, are likewise constructed and will be ready for traffic after the completion of the Etoile station during the course of the summer.

The stations are 18 in number upon the line from Port Vincennes to Porte Maillot, 4 upon that from Place de l'Etoile to the Trocadéro, and 3 upon the Porte Dauphine branch.

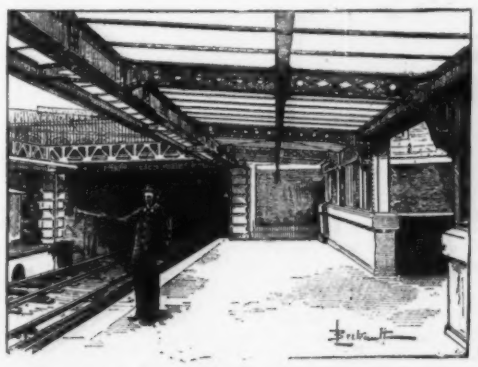


FOOT-BRIDGES OF BASTILLE STATION.

ONE OF THE STATIONS OF PLACE DE L'ETOILE.

As some complementary work remains to be done also at certain stations, they are not all opened at the outset. The following are the names of the stations at which the trains will stop for the present: Porte de Vincennes, Lyon, Place de la Bastille, Hotel de Ville, Palais Royal, Champs Elysees, Rue d'Obligado and Porte Maillot. The line is underground for its entire extent, the Bastille station alone, established upon the widening of the place, at the crossing of the Saint Martin Canal, being in the open air.

The stations are, as a general thing, constructed upon the same plan. They have two platforms 13 feet in width and 246 in length, placed on each side of the line, and on a level with the floor of the cars in order to facilitate the entrance and exit of the passengers.



INTERIOR OF BASTILLE STATION.

ENTRANCE TO THE PORTE MAILLOT STATION.

The stations are either vaulted or roofed with metallic girders according to their depth beneath the public thoroughfare. They are reached through a stairway leading from the street or sidewalk to a subterranean hall situated, on an average, 10 feet below. Here are found the ticket wickets, and alongside, the bookstand of the station. As no money is given out at the wicket, the passenger, if he needs any, has to go to the bookstand, which is obliged to make change gratuitously. From this hall starts a passageway, at the two extremities of which a distinct stairway leads to each of the platforms. The Hotel de Ville and Palais Royal stations, represented herewith, give an idea of these general arrangements.

The station of Place de la Nation and the stations of the Champs Elysees and Trocadéro, by reason of the traffic that is expected to occur on certain days, have two distinct approaches. The same is the case at the Bastille, where a system of covered foot-bridges and stairways facilitates access to the Vincennes station. An underground gallery ending at this station enables passengers to avoid the dangerous crossing of Rue de Lyon.

The terminal stations of Porte de Vincennes, Porte Maillot and Porte Dauphine are divided into incoming and outgoing stations, each provided with an approach. It is between these two stations that is situated the loop that permits trains, after discharging their passengers, to turn around and present themselves at the station in order to take on outgoing passengers. In order to render the approaches to the stations more apparent, they have been provided provisionally with a wooden portico bearing the inscription, "Chemin de Fer Metropotain, Station de. . . ."

These stairways will ultimately be covered with small structures of elegant design, roofed with glass, to protect passengers against rain. The establishment of such structures, however, has not been authorized for the stations of the center comprised between the Hotel de Ville and Place de l'Etoile. It is to be hoped that the protests that will not fail to be made will cause the administration to remedy this matter. The entire interior of the stations is faced with white enameled tiles, which constitute a pleasing, clean and hygienic decoration. The electric light, moreover, is distributed therein to profusion. This light is not confined to the stations, but is continued all along the tunnel, and, in combination with that of the cars, gives a cheerful and warm impression, of a nature to remove all apprehension from persons who fear underground traveling.

In the stations, the platforms are lighted by a row of incandescent lamps spaced about four yards apart and completed in the principal stations by powerful arc lamps.

In the tunnel, they are arranged in quinconxes and succeed one another at a dozen yards interval. This question of lighting leads us very naturally to speak of the electricity necessary, not only for the light, but for traction.

The current is at present furnished by the sector of the Campagnie de l'Air Comprimé, while awaiting the completion of the special generating works of Quai

RÂpée. In this works, five generating groups constructed by Creusot will furnish a triphased current of 5,000 volts, which will be transformed into a continuous current at a voltage of 550 and be distributed in this state to the automotor cars through the intermedium of an insulated rail extending along the entire length of the line. Such transformation will be effected in the electric sub-station of Place de l'Etoile, now about completed. The stones used for the construction of this sub-station were derived in great part from the demolition of the Palace of Industry and the Théâtre Française.

The trains of the Metropolitan are made up of three cars, an automotor, one and two passenger cars. These latter are entered through two sliding doors placed at the extremities. One of these doors is reserved for the entrance and the other for the exit of the passengers, so as to prevent confusion.

They are capable of accommodating thirty passengers seated and a dozen standing. The automobile carriages differ from the others only in the addition of a compartment in front containing the apparatus for controlling the electric motor and the brake, and in which the driver stands. They are of two classes. Our engravings show the interior of a car of the second class and a mixed car, on the side of a compartment of the first class.

In the compartments of the first class, the seats are provided with cushions covered with brownish red leather; in the others the seats are formed of strips of varnished wood, and are very neat and comfortable. Wire nettings for small pieces of baggage installed above the seats are supported by metallic rods that serve also as a support for the passengers who stand in the central aisle.

Let us add that these carriages have an elegant aspect and are brilliantly lighted by means of ten electric lamps.

The company owns a rolling stock yard that contains 161 cars of all kinds, that permit it just at present to put in circulation trains that succeed each other at five minutes' interval, and even at two minutes during the busiest hours.

Each automobile carriage is provided with two 200 horse power motors, that receive the electricity necessary for their operation through the intermedium of shoes in continual contact with the trolley rail. All the cars, of whatever kind, are provided with automatic compressed air brakes. The maximum speed authorized is 21 miles an hour, but the normal running is regulated at a speed of from 15 to 18 miles only, permitting of making the trip from Vincennes and Porte Maillot in half an hour, stoppages included.

One peculiarity to be noted is that, contrary to what occurs upon the French railways, the trains of the Metropolitan run upon the right track, like tramway cars.

The fare is extremely moderate: 0·25 franc for first class and 0·15 franc for second class, whatever be the distance.

In terminating, let us say that the question of security has been particularly studied, and that the electric signals, as well as the block system adopted, offer every guarantee. The block system is that of Hall, which is applied in America upon many thousands of miles of railways, and which has the great advantage over the systems used in Europe that it always leaves two intervals of the block, protected by signals, closed behind a train. Its operation is automatic, the train itself closing the track behind it by means of a pedal.

Finally, let us note that the Metropolitan possesses, in the Quartier de Charonne, workshops, a depot of material and shunts connected on the one side with the terminal loop of the Porte Vincennes station, and on the other with the tracks of the belt railway in the Charonne-Marchandises station.

According to the agreement annexed to the law of March 30, 1898, the system conceded has been divided into six sections. The first has just been completed, while the others will be successively constructed in the following order:

(1) Section B.—Circular line through the old external boulevards;

(2) Section C.—From Boulevard de Courcelles to Menilmontant;

(3) Section D, First part.—From Porte de Clignancourt to Boulevard de Strasbourg; and Section E, from Boulevard de Strasbourg to Pont d'Austerlitz;

(4) Section D, Second part.—From Boulevard de Strasbourg to Porte d'Orleans;

(5) Section F.—From the Cours de Vincennes to Place d'Italie.

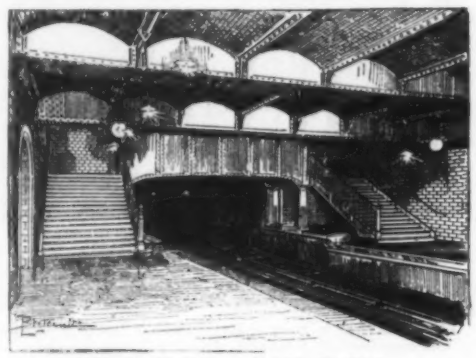
It is asserted that work on Section B will be begun next October.—L'Illustration.

A large number of electric launches are being used on the Thames this summer.

THE TWENTIETH ANNIVERSARY OF THE EDISON INCANDESCENT LAMP.

TWENTY years ago Mr. Edison, after two years of experimental work, gave the first public exhibition of his incandescent lamp in his laboratory at Menlo Park, and early in 1880 started the first Edison lamp factory. It is an interesting fact that the lamp to-day contains the same elements that it contained 20 years ago, none having been added and none omitted from the lamp during this period of time, and yet each of the elements which constitute the lamp has been so changed and developed that the lamp to-day is different in every respect, both in appearance and performance, and also in economical construction. This last item is well illustrated by the fact that 20 years ago lamps sold at $1.00 in the same quantities for which they now sell at 20 cents, and the profit per lamp is very much more now than it was then; in fact, it is believed that lamps sold at $1.00, 20 years ago, were sold at a loss.

The lamp bulbs of 20 years ago were made at the



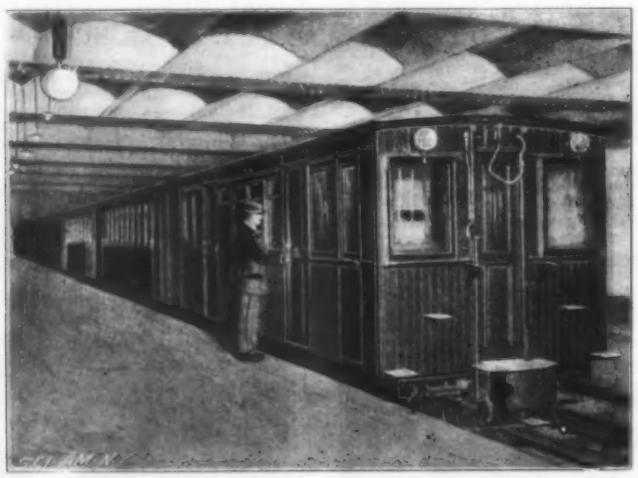
STATION OF PALAIS ROYAL.

lamp factory from glass tubing, being blown by eye without any other guide, so that their shape could not possibly be more uniform than the skill of various operators could make them. The bulbs are now blown in a mould at the glass works, insuring uniformity of shape and size.

The filament of the lamp has changed very materially, both in appearance and in character. It was then made of bamboo, cut to the desired size by plane. This planing required eight different operations before the piece was reduced to the desired size. This was not only expensive, requiring very accurately made tools, but even at best it was very difficult to make a filament which was as uniform in size as the requirements of the lamp demanded.

The old bamboo filaments were put into the lamps just as they came from the carbonizing furnace, so that the performance of the lamp was limited by the temperature which this piece of wood charcoal would stand. This temperature was nothing like as high as is possible with the present filament, which has the graphite coating that is now added to the filament after it comes from the furnace.

The efficiency of the lamp, which is ordinarily expressed in watts per candle, is determined by this temperature, and the difference between the old and the new may be well illustrated by the figures of 6 watts per candle-power in the lamps of 20 years ago, and 3·1 watts per candle-power at the present time.



A TRAIN IN THE PALAIS ROYAL STATION.

This difference in efficiency does not tell the whole story, because the filament of 20 years ago was a plain loop, which, although it gave 16 candle-power in the position in which lamps are measured, yet the total light given by a 16-candle-power lamp then was much less than that given by a 16-candle-power lamp now, because the present filament, being of the well-known oval form, gives a much larger light in the positions other than the one in which lamps are measured than did the old one; thus the old loop measured through the tip of the lamp, only gave three candles, whereas the present lamp in that position gives seven candles.

The glass tube which supports the filament from the bottom of the lamp has been developed very considerably, although in appearance it is much the same. The tendency of the change has been to reduce the necessary amount of platinum used in the old lamp. In the old lamps probably 10 times as much platinum per lamp was used as is used to-day, and yet the platinum of to-day does its work just as well as it did in the old lamps with the larger amount used.

The base of the lamp has been improved, not only in appearance, but also in performance, as the old bases were constructed on a bad principle, which caused many of them to break in use.

The last, but one of the most important elements in the lamp, which, although important, is invisible, is the vacuum. Vacuums were produced 20 years ago as good as can be produced to-day, but great improvement has been made in the methods of getting it, and in the uniformity with which it is made. Twenty years ago it took five or six hours to exhaust a lamp, whereas now they are exhausted in one minute, while the proportion of inferior vacuums produced 20 years ago was very much greater than it is to-day.

The improvement in methods of manufacture, which is illustrated by the great reduction in cost mentioned before, may be further illustrated by the fact that only a few years ago the cost per lamp produced of the breakage incurred in the manufacture was greater than the total cost of the lamps at the present day.

Another element in the lamp, the changes in which have been plainly evident to the eye, is the joint between the filament and the platinum leading-in wire. In Edison's early lamps this joint was made by means of a small screw clamp, the filament being squeezed into the jaws of this by a screwdriver, which was a very expensive method.

This was followed by a copper-plated joint, the leading-in wire being folded around the end of the filament, and the whole joint being covered by copper by electrodeposit.

Both these methods required that the ends of the filament be enlarged so as to cell the filament before it came in contact with the metal. This required greater accuracy in the cutting of the filament, as, being made with enlarged ends, there was no possible variation in length after it was carbonized, and if it was made wrong originally it could not be changed.

The present filaments are made longer than they are needed and cut to the right length after they are carbonized. This is made possible by means of a carbon joint between the filament and wire, which is not injured by the high temperature at the point where the filament leaves the joint.

This carbon joint was first made by folding the leading-in wire around the filament and heating the joint so made very hot under gasoline. The heat decomposed the gasoline and deposited a carbon covering on the joint, which made a very perfect connection.

This was superseded by the present carbon joint which is applied in the form of a carbon paste, which after being baked in a furnace (which decomposes the hydrocarbon liquid element of the paste), forms a dry carbon joint which is quite satisfactory.

A very great deal of work has been done in the development of each of the elements of the incandescent lamp, and the development of each must be done with a knowledge and consideration of all the other elements, as a change in one element may be very good considering that element alone, but may affect the others disadvantageously.

This makes a problem with several factors in it, all of which are very important, and the effect of a change in one is often very difficult to trace to the element which has caused it, as the effect often appears as far distant from the cause as is possible.

The success of the Edison lamp has been very materially aided by the system of inspection employed at the factory and by the very accurate selection of lamps, so that each lamp is shipped for use at the voltage for which it is best adapted. A lamp used on its proper circuit will give a satisfactory result, whereas the same lamp on a wrong circuit will perform very badly.

It is endeavored that all lamps be shipped for use on a proper circuit, and this is only possible where the lamps produced by the factory are such as will fit the circuits for which it has orders.

To accomplish this result, very careful attention must be given to the processes in the factory which determine the voltage and candle-power of a lamp when finished. There are used in the factory pieces of apparatus which measure the diameter of the filaments to the one-forty-thousandth of an inch. Enough of these instruments to do all of the work are in constant daily use in the factory, handled by regular employes, so that it is a commercial machine and not a mere laboratory tool.

The other essential measurements of the filament, which is the determining factor of the candle-power and voltage of the lamp, are also done with great accuracy, and the result is the manufacture of useful lamps only, so that there is no temptation to ship lamps wrongly assorted in order to get rid of undesirable work.

The system of inspections which cause the rejection of lamps for faults which would not have received consideration a few years ago is a considerable expense to the factory as apparently good lamps, and frequently good lamps, are rejected and made up to standard or else broken up.

While the immediate effect of such inspections and rejections is to increase the expenses, the ultimate effect is to increase the business on account of the greater excellence of the lamps which are shipped. The result of this policy is shown in the very large increase in business during recent years.

The Edison Lamp Factory of the General Electric Company turns out 55,000 lamps per day, or nearly 16,000,000 lamps per annum.—Electrical Review.

THE DARDEAU DIRECT-CALL TELEPHONE.

THE traveling platform that has become a popular method of transport at the Paris Exposition has a system of telephone communication by means of which rapid communication is provided over the whole extent of the line, wherever inspecting posts are fixed. That efficient surveillance is necessary on a system that comprises a very large number of isolated electric motors is evident, and facilities of communication all round the line, with the offices, central station, and shops of the company, largely facilitate the work of inspection. The same necessarily attaches to the associated electric railway, the traffic on which is constantly increasing, and the interval between trains growing less. It was desirable that the whole working of both these lines should be followed and controlled from the central office, and to do this the first application of the Dardeau direct-call telephone has been made. The installation is the work of the Société

Industrielle des Téléphones, one of the largest establishments of its kind in France, and to which we are indebted for the following information:

The special functions of the apparatus may be summarized as follows: Being given the different stations of a railroad or tramway, the locks of a canal, or any succession of different points, which it is desired should be connected telephonically or telegraphically, and which may be called *A*, *B*, *C*, *D*, etc., the following conditions must be complied with:

1. That one of the stations, *B*, for example, can call up any one of the others; *F*, for example, without interfering with the remainder.

2. That communication being established between *B* and *F*, all the other stations are notified by a visible, not by an audible signal, that the line is occupied; this signal disappears when communication between the two stations speaking is cut off.

3. That no station on the circuit, except these two for the time in communication, can overhear, or otherwise interfere with the conversation between these two stations.

4. That in case of emergency it should be possible, from one of the stations, *A*, *C*, *D*, *E*, etc., to cut communications between *B* and *F*, by calling up *F*, for example, to explain the necessity of the interruption, and to temporarily vacate the line.

5. That, if necessary, it should be possible, by a special device, to communicate with special stations, or, indeed, all the stations on the line simultaneously.

6. That in the case of a Morse telegraph installation, if the operator at the station called up be absent, it is possible to send a dispatch to this station, the Morse instrument being started by the calling-up current, and thrown out as soon as the message is printed.

7. That all these different results should be obtained with a single circuit passing through all the stations that have to be connected.

All these various and complicated conditions are complied with in the Dardeau system in a very simple and ingenious manner by the use of positive and negative currents. The number of stations that may be connected is not limited theoretically; in practice, however, it is difficult to exceed the number of twenty-five stations; if this number is larger, it becomes necessary to divide the line into sections, with a coupling station between each section, this station being in charge of an operator, who carries out the instructions received from the various calling-up stations. Two lines equipped with the Dardeau system may each end at a given point or junction station, which will serve as a means of communication without the two lines being directly connected.

The equipment of an ordinary direct call station is as follows:

One call.
One microphonic transmitter and two receivers.
One special relay.
One bell.
Three batteries, one for calling up, a local, and a microphone battery.

The call apparatus consists of a clock movement and two keys; outside the case only two buttons are visible, one black and the other white, and a dial with an index needle. This needle is marked with the following indications: At the top is a + marking the zero position of the needle; then successively toward the left are the words "cut out," followed at equal intervals by the figures 1, 2, 3, etc., corresponding to the number of stations; finally, next to the cross on the right, are the words "general call." When the needle is opposite the + mark the line is open and any station may be called up. Assume that this station is No. 5; then the white button is depressed, and by doing so the "cut out" or "engaged" signal is given at all the stations by the needle of each dial stopping opposite the word. The black button is then depressed as many times as correspond to the number of the station to be called; in the case supposed five depressions brings the needle opposite 5 on the dial. It should be mentioned that before operating the black key, the white one must be depressed to set back the needles on all the dials in the different stations, otherwise no current would pass, but no other inconvenience would follow. When the needle is opposite 5 on the calling-up dial, the white key is pressed, which rings the call bell of the instrument in Station 5. The operator at No. 5 answers the call by depressing the white key of his apparatus and unhooks his receiver; as soon as the operator of the calling-up station has received the bell response, he detaches his instrument and the conversation is carried on. When terminated, the person at the calling-up station repeatedly presses the black key of his instrument. This brings back the needles on all the instruments on the line to zero. The number of depressions is immaterial so long as it is greater than that of the stations; after coming back to zero, the needle will not move further, if the black key only be depressed.

The installation of a connecting station between two lines equipped with the Dardeau apparatus is, of course, somewhat more complicated and requires the following apparatus:

Two calls.
One microphonic transmitter and two receivers.
One call and reply commutator intended to put the telephonic instruments and the call battery into connection with one or other of the two lines.
One intercommunicating commutator for connecting the two lines.
Two special relays.
Two line bell apparatus.
One switching-off bell.
Five batteries (one call, two local, one microphone, and one for switching off bell).

Each of the call apparatus and the relays is similar to those already referred to. In operation the key of the intercommunication commutator can take two positions, one out of, and the other in, connection. The call commutator can also take two positions, 1 and 2, the former corresponding to its connection with the first and the latter with the second line. Assuming that a station on one of the lines wishes to speak to the central, which it first calls up as already described, the central operator turns the commutator switch to the line (1 or 2) calling, and replies with his bell signal; the conversation finished, the needles on all the dials of the various stations are restored to zero by the usual manipulation. If the central station wishes to talk with a station on either of the two lines, the central operator shifts the commutator key to the position 1 or 2, according to which line he requires when connection is made, and all proceeds as before. When a station on one line wishes to talk to a station on the other, the station on line 1 calls up the central, who, after learning what is wanted, rings up the operator at the station on line 2, and informs him that such and such a station on line 1 wishes to connect; he then joins the two lines by the intercommunication switch, and all proceeds as before. When the conversation is finished, of which the central operator is apprised by signal, he cuts off the two lines, and by depressing the black key of his instrument, restores the needle of every station to zero.

Certainly the excellent way in which the system is working at Paris, on the platform and the electric railway, appears to show that too much has not been claimed for it by its inventor.—Engineering.

THE BIOLOGICAL LABORATORY AT COLD SPRING HARBOR, L. I.

By W. G. BOWDOIN.

Two classes of work are being done at the Biological Laboratory at Cold Spring Harbor. The first consists of the general instruction of students and the second of research on the part of specialists. A rich and exceedingly varied animal and vegetable life characterizes Cold Spring Harbor and the students, whom are for the most part teachers, are taken out into the fields and the woods; along the streams, upon the salt and fresh waters, by those in charge of classes, and collections are made along the lines of study. The desired botanical or zoological specimens being secured, the gatherings are then taken to the laboratory for examination and identification. A member of the Board of

THE DARDEAU DIRECT-CALL TELEPHONE.

Instruction lectures upon the anatomy, habits and other features of the insect or plant that is being considered and notes are taken upon the lecture. Laboratory work supplements the field work, and the two go hand in hand. Theory and practice are combined in such a way as best to fix the study theme upon the minds of those in the various classes, and the results are very satisfactory. The school has steadily grown in numbers. The present season is the eleventh. Provision has been made to afford instruction in the departments of bacteriology and in comparative anatomy, but the interest in these branches is minor and the number of students is limited. The study of anthrax bacillus and its effect on rabbit tissue and the anatomy of the black snake (Bascanium constrictor) is about all that is being done in these departments at present. The principal interest is centered in botany and zoology. D. S. Johnson, Ph. D., of Johns Hopkins University, has charge of cryptogamic botany, and H. C. Cowles, Ph. D., of the University of Chicago, lectures upon phanerogamic botany. Prof. Charles Benedict Davenport, Ph. D., the director of the laboratory and of the University of Chicago, assisted by Stephen R. Williams, A. M., of Harvard University, conducts the class in zoology. Large collections of insect and other zoological forms have been made by the students, which will go to various schools in Chicago, Allegheny City, Pa., Ann Arbor, Mich., Bloomfield, N. J., Baltimore, Md., Easton, Pa., and elsewhere. In botany both the flowering and flowerless plants, including fungi and algæ, have been collected and studied. In connection with the botanical class a botanical survey of Long Island has been projected. Much progress has been made, and Huntington and Fire Island have already been visited in the conduct of this survey. Eaton's Neck, Montauk Point, and Lloyd's Neck will probably be reached before the close of the present season, and the work will go forward next year until the survey is complete. The laboratory expected to have had the use of the United States Fish Commission steamer, "Fish Hawk," for the purpose of dredging in Long Island Sound, but the boat being disabled until so late in the season, the work of the Fish Commission did not permit of such use. The naptha launch, "Rotifer," has, however, frequently been used.

Geologists will find interesting formations at Cold Spring Horbor, glacial murains abounding, and a drowned river valley of a long past geologic age being one of the features of the present sea encroachments. A recent find in the department of botany may prove to be a new species of mushroom, a flat kind supported by twin columns having been observed and photographed.

W. L. Tower, B. S., one of the Board of Instruction and of Harvard University, is conducting a series of experiments relating to the Colorado beetle (Doryphora decemlineata). His cultures are arranged to take place at a temperature of about 16° centigrade, which is about the mean temperature of Nova Scotia, New Foundland, and Northern Canada—variations in moisture are introduced, and the artificial conditions approximate, so far as possible, the conditions of nature, except, of course, in so far as winds are concerned, the variation of temperature and other natural phenomena that cannot be artificially reproduced. The results of a former series of similar experiments, covering nearly three years, were lost in a fire some two years ago, but Prof. Tower now hopes to be presently able to show that climatic conditions and variations in moisture fully account for the differentiation of species now typically represented in tropical and temperate climes. Some jellyfish showing magnificent fluorescence were on exhibition at the laboratory aquarium recently. They were very shortlived. Prof. C. P. Sigerfoos, Ph. D., of the University of Minnesota, is engaged in research upon the Squilla empusa or Mantis shrimp and its embryology. A student from Columbia University is studying the eastern ladybirds (Anatis ocellata), whose food is the squash vine. Dr. Jerould's topic of study is the embryology of the sand worm. Miss L. M. Snow, of the Girls' Latin School, Baltimore, Md., is making a special study of vegetation as it occurs in or near fresh, brackish, and salt water and the resulting variations according to the dominant influence. Hermit crabs occupy all the abandoned shells at Cold Spring Harbor.

Pine buildings constitute the present equipment of the laboratory, viz., the laboratory proper, a lecture hall with lantern for projections, a dining hall and three dormitories. Ten or twelve small boats are available for collecting purposes, together with needful apparatus, microscopes, and other accessories. The New York State fish hatcheries are located near the laboratory. Some attempts have been made both at the hatchery and at the laboratory to propagate the lobster that the canning establishments have all but exterminated. The nearest approach to the royal road to learning is to be found in the summer schools of which that located at Cold Spring Harbor is a type.

A reference library of about a thousand volumes and pamphlets are available for the use of students. Prof. H. G. Barber, of the Boys' High School, New York city, is now preparing a check list of the insects to be found at Cold Spring Harbor, which will be published upon the completion of his labors.

THE FUTURE OF CHEMICAL PRODUCTS USED IN THE CULTIVATION OF THE SOIL.*

As there are in the life of man certain epochs for taking a survey of the past and the future, it is suitable at the close of the century, or the commencement of a new one, to take a look at the past and present of the industry of chemical manures. In the past we recognize with gratitude the work of our countryman, Justus de Liebig, the veritable creator of this industry. From the year 1839 he made public in numerous writings the new sources for the nutrition of the vegetable kingdom.

We recognize the progress that has since been made, but still in most countries the old methods have been adhered to, although these are usually opposed to scientific laws.

Thanks to the means of comparison by which the necessity of the employment of chemical manures can be proved and explained, the certain development of this industry can be surely foreseen.

The scientific calculations of Sir William Crookes have proved that, with the increase of the population of the globe, the soil, as now cultivated, will not produce the necessary wheat beyond the year 1920.

Science can parry the danger with which we are threatened, as the most important resource, chemical products, will come to the succor of humanity.

The following is the average production of wheat per hectare in the principal countries:†

	Hectoliters.		Hectoliters.
Denmark	32·34	France	15·29
England	25·65	Austria	14·19
Belgium	21·64	Hungary	11·90
Germany	18·08	Italy	9·57
Russia	7·74	United States	12·00

If the average production of the countries of the world is only 11·52 hectoliters, it is evident what lever must be put in action for the alimentation of the increasing population.

The reason why in certain countries the yield of wheat is relatively large, while in others it is small, is found in the fact that the cultivation is more rational, and artificial manures are used in the former, while in the others they are not used; or, if so, only to a limited extent. From this springs the certainty of the large future development of chemical products.

Germany, France, and England are countries using artificial manures the most, and their cultivation is the most advanced. Although in these countries comparatively only a small quantity of phosphoric acid is used, yet there is a great difference in the production as compared with Spain, Italy, Hungary, Russia, the United States of America, and Japan, where the em-

* From the German correspondence of La Phosphate.

† A hectare (100 acres) is ten thousand square meters, equal to about two and a half acres English. A hectoliter (100 liters) is equivalent to about two bushels and three-fourths.—Trans.

ployment of chemical manures has been scarcely commenced. There are portions of the world, like Australia and Africa, where it may be said that their use has not yet been commenced.

Taking account of this fact, and reflecting on the constant progress of the race, we can conclude that rational cultivation will be extended. The consumption of phosphoric acid is undoubtedly susceptible of a logical and prodigious development. The production of the phosphates is to be considered, that is, the sources from which phosphoric acid is derived.

Fortunately, there are sufficient to provide a greatly increased annual consumption at a comparatively moderate price. The principal deposits in Europe, such as those of the Somme, of the Pas-de-Calais, of Oise, of the district of Liège, of the Mons basin, are nearly exhausted, and Europe can no longer rely to any great extent on these deposits. This is true also of certain other countries, but great reliance can be placed on Florida, Tennessee, Carolina, Algeria, and Tunis.

The German market draws little from these countries except the Florida rock of the high grade of 78 per cent., designed for the manufacture of superphosphate of 18 per cent. soluble in water.

For the manufacture of superphosphates of low and medium grades, the most suitable are the Algerian phosphates, having from 63 to 70 per cent. of tribasic lime phosphate, on account of their comparative freedom from iron and aluminium; these phosphates are sold with a guarantee that the maximum shall not exceed 1 per cent.

The Algerian phosphates are an excellent product for the German manufacturer, considering that the phosphoric acid is paid for on the basis of its solubility in water.

The Tennessee phosphates are for this reason less appreciated in Germany, on account of the higher proportion of iron and aluminium. On the contrary, they are a valuable product for France, Italy, and Belgium, where the price is based on the phosphoric acid soluble in citrate.

In England, besides the rich phosphates of Florida, Tennessee, and Algeria, the Carolina phosphates, which are specially suited for that country, are much employed.

The Algerian phosphates find also a market in many other countries of Europe, as Austria, Hungary, Italy, France, Belgium, Holland, Russia, Roumania, etc., not only on account of their quality, but also on account of the less cost of transportation, resulting from their geographical situation.

Although the United States, Algeria, and Tunis are in the way of furnishing annually and regularly for a long time to come large quantities of phosphates, the production in a future, not very remote, may not be sufficient for all the consumption. This will not appear a paradox if we consider the enormous quantity, should all the countries practice a rational and perfected cultivation.

A fact yet to be considered, although of less importance, is that foreign blast furnaces, and even some of those in Germany, now make use of certain phosphates which are also employed by the manufacturers of manures in southeastern Germany, France, and Belgium. The manufacturers must, therefore, have recourse in future more or less to other phosphates.

This competition of the blast furnaces will certainly affect the price of the phosphate. Every event of this character ought to be taken into account, for there is no overproduction in the general market.

Production and consumption corresponding with each other, it is easier to consider prices.

The stability of the market has been much enhanced. The transactions in Florida phosphate are now in the hands of certain strong American capitalists who have the means and will to maintain their prices. They wish to make sure of a reasonable profit. There has been recent talk of forming a syndicate.

The idea of syndicating is popular in America, and we should not be surprised if it were realized. In Algeria the formation of the Algerian Company has already absorbed the most important mines. We notice the tendency to consolidation everywhere; it is with phosphates as with other industrial branches. This tendency is, of course, not favorable to the buyer. Do we not notice the same tendency with the Thomas scoria? This second great source of phosphoric acid for agricultural use is, of course, of little importance compared with the superphosphates yielding phosphoric acid soluble in water.

The Thomas scoria is employed in Germany, but to a small extent in other countries. The quantity of phosphoric acid soluble in citrate which the Thomas scoria put at the disposal of agriculture is also limited by the production of steel, as the scoria is only the waste of this manufacture.

Casting our eyes over the present manufacture of chemical manures and the prospect of their employment in future, we cannot fail to be satisfied.

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